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Front cover: Fallen Pandamus *tree silhouetted against the quiet waters of Heron Island lagoon in Australia's Great Barrier Reef Marine Park. Tiny islets composed entirely of coral sand and hurricane-adapted vegetation are a hallmark of the region, which also contains the world's largest aggregation of submerged coral reefs.* ANPWS photo by Alan Robinson

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Graham C. Morris

The Great Barrier Reef Marine Park: A Unique Management Concept

In 1975, the Commonwealth (Federal) Government of Australia passed the Great Barrier Reef Marine Park Act, which provides for the "establishment, control, care and development of a marine park in the Great Barrier Reef Region." The legislation represented the culmination of the efforts of many people, both within Australia and overseas, who had expressed concern over the long-term survival of one of the world's greatest natural treasures in the face of rapidly increasing development of reef-related industries. Of particular concern was the perceived threat of danger to the Reef from commercial mining and oil drilling, activities which are specifically prohibited within the Marine Park under the provisions of the Act.

In 1981 the Reef was included on the UNESCO World Heritage List, thereby bringing international recognition to the importance and uniqueness of this vast complex of coral reefs and associated life forms. Australians take very seriously their responsibility for caring for this portion of the world's natural heritage.

Figure 1. *Map of the Great Barrier Reef Region, showing the boundaries of the Marine Park as at July, 1983.*

Description

The Great Barrier Reef is not really a single reef, but rather a collection of about 2,600 separate coral reefs, shoals and other formations occuring on the shallow continental shelf off the east coast of Australia. It collectively stretches more than 2,000 km from the middle of the east coast nearly to Papua New Guinea, and encompasses about 350,000 km² (134,000 sq mi). About six percent (20,000 km²-7,800 sq mi) is actually composed of coral reefs, the remainder being vegetated sea bottom or sea grass and algae beds.

In the north, the shallow continental shelf is relatively narrow (20 to 30 km), and supports long narrow ribbon reefs on its outer edge. Just outside these reefs depths plunge spectacularly to 2000 m. To the south, the shelf widens to nearly 300 km and contains a maze of patch reefs separated by open water or narrow winding channels.

Some 250 reefs support low coral islands (cays), although only 56 are permanently vegetated. Numerous continental (high) islands and large rocks are scattered throughout the region, many surrounded by fringing coral reefs.

This diversity of reef types and islands is overshadowed only by the diversity of the fauna that abounds on the Reef. An estimated 1,500 species of fish and more than 300 species of hard, reef-building corals are known; more than 4,000 mollusc species and 10,000 species of sponges have been collected. Two of the Reef's six species of turtles — green *(Chelonia mydas)* and loggerhead *(Caretta caretta)* — are registered as endangered, as is the aquatic dugong *(Dugong dugong)*. More than 240 species of birds have been recorded, with approximately 130 species breeding within the region.

Marine Park Jurisdiction

Not surprisingly, in a marine area of such size and complexity, there are some complicated questions of jurisdiction between the Federal Government and the State of Queensland. Basically, federal jurisdiction applies only to areas below low water mark (ex-

cept on Commonwealth-owned island), whereas state jurisdiction applies above the low water mark and on all islands which are part of the state. These latter islands are actually national parks under the state system, and the intertidal zone between low and high water is similarly protected under state legislation. Jointly then, commonwealth and state protection extends from the islands' summits to the sea floor.

To ensure implementation of the Marine Act, a statutory Great Barrier Reef Marine Park Authority was created with a variety of specific functions. These include recommending areas within the region to become a part of the Marine Park, drafting regulations, undertaking or commissioning research, and preparing zoning plans.

Agreement between the Federal and Queensland governments has delegated the day-to-day management of the Marine Park to the Queensland National Parks and Wildlife Service, subject to Authority direction. Negotiations are under way to establish a management system that ties together the various jurisdictions, namely those areas below low water mark, above high water mark, and the intertidal.

The Authority, therefore, has a relatively small staff (approximately 50), concentrating on planning, establishment and subsequent zoning of the Marine Park, research and monitoring, development and direction of management plans, education, and inter-governmental liaison.

To date, two relatively large sections of the region have been declared Marine Parks, the Capricornia (11,800 km²) and Cairns (34,000 km²). One small section, Cormorant Pass, also has been created to protect an important colony of the large potato cod *(Epinephelus tukula)*. These sections, while representing only 13.4 percent of the region, already are the largest marine park areas in the world. It is likely that most of the remainder of the region will be declared Marine Park by the end of 1983, with the zoning process taking several years longer.

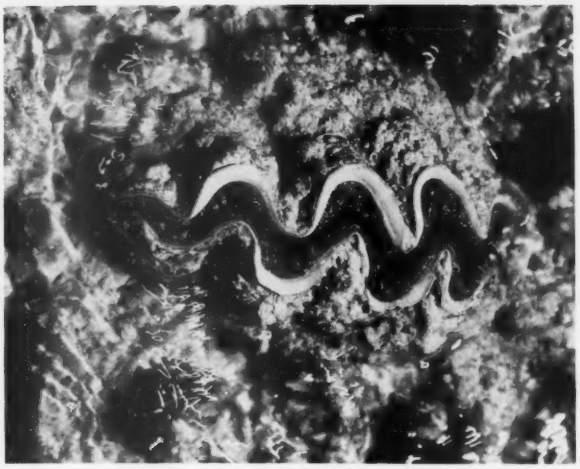
The Park Concept

It may be difficult to visualize a "park" consisting only of the water, reefs and seabeds that make up the Great Barrier Reef. There are no fences, no gateways and, except at low tide, few distinguishing features to be seen at sea level. Most of the islands, both continental and coral, within the outer boundaries of the Marine Park are national parks in the terrestrial sense, and are not part of the Great Barrier Reef Marine Park.

The Great Barrier Reef Marine Park has been established to conserve the reef; that is, to allow reasonable use to continue, while providing for public enjoyment and appreciation and the overall protection of the reef. Reasonable use is defined as that which can be sustained by the resources available; which causes minimal damage to other elements in the ecosystem; and which does not unduly interfere with the activities of others. Determining the limits is not an easy task, particularly as tropical marine research lags far behind comparable terrestrial research.

It would probably help to think of the Great Barrier Reef Marine Park as similar to a town or country plan which consists of various zones for specific purposes. In the Marine Park these purposes include fishing, recreational pursuits, research and, in some cases, total protection. It is this variety of legitimate, but sometimes conflicting, uses that must be accommodated which makes it so important for the Park to establish publicly accepted multi-use zoning and management plans.

The Marine Park concept has another aspect which sets it apart from other parks. Management here nearly always means "people management," not "resource management." there are no planting, weed control or burning programs to improve the Reef's resources, for example. It is doubtful that the region could withstand the ever-increasing impact of man without the protection offered by the Marine Park; whether all the pursuits of man can and should be equally accommodated is as much a question for the social scientists to answer as for the physical and biological scientists.



On the shallowest reefs, countless million of animals, like this giant Tridacna *clam, have managed to cement themselves into the reef to keep from being swept away by heavy waves. They feed by filtering out tiny organisms brought to them by tides which rise and fall 6 to 9 feet (2-3 meters). ANPWS photo by Alan Robinson*

Zoning The Park

It is a statutory obligation that the Authority involve the community in the complex task of zoning the Marine Park. The Authority takes this responsibility seriously, for it knows there is a tremendous store of Reef knowledge in the community which can be tapped, and acceptance of zoning plans will be greatly enhanced if the community has been actively involved in the development.

A number of zones have been established within the Marine Park, where certain defined purposes of use and entry are allowed. These zones are not mutually exclusive (see chart); the number of zones may vary greatly from one area to another, or may change depending upon the season. There are provisions to close certain reefs and shoals from time to time: included are replenishment areas, which may be closed to fishing and collecting for a specified time to allow for regeneration of fish stocks and other resources; seasonal closure areas, which may be closed to public access during the breeding season of certain species of fish, turtles or birds; reef appreciation areas, which provide small areas on heavily used reefs in which the public may observe and appreciate undisturbed marine life; and reef research areas, which provide small areas on reefs in which specified research may be undertaken undisturbed by other activities.

Certain activities, although provided for in a particular zone, could be potentially damaging in a particular site; in such instances permits may be required as a means to control the activity or the number of people, or both. Permits also provide long-term data on uses such as research, collecting, tourist operations and education programs, all of which is valuable for future refinement of zones and management planning.

GREAT BARRIER REEF MARINE PARK USE ZONES

ZONES	FUNCTION	PERMISSABLE USES	PROHIBITED USES	EXAMPLES
General Use "A"	Buffer	Most activities, some require permits	Commercial spear-fishing, spear-fishing with SCUBA	Between non-park area and more restrictive zones
General Use "B"	Buffer	As above	As above, plus trawling and commercial shipping	As above, but where bottom disturbance is unacceptable
Marine National Park "A"	Recreational	Non-commercial light fishing	All other fishing and collecting	Reefs requiring nearly total protection
Marine National Park "B"	Recreational	Non-consumptive, non disruptive activities only	All consumptive activities	Areas open to public strictly for observing undisturbed natural systems
Marine National Park Buffer	Buffer	Trolling for deep water fishes	All other consumptive activities	Around otherwise completely protected reefs
Scientific and Preservation	Research and special protection	Research and monitoring	All non-research or monitoring activities	Areas closed to public and exclusively available for research
Periodic Restriction	Closure or restriction for special purposes	As designated	As designated	Seasonal closures, replenishment areas, special tourist areas, temporary research projects

Managing The Park

Delegating day-to-day management of the Marine Park to Queensland takes advantage of available expertise: for many years the then Queensland Fisheries Services had been managing two small popular marine parks (off Green and Heron Islands); Queensland National Parks and Wildlife Service was already managing numerous island national parks within the region. With an amalgamation of staff from the two agencies, a Marine Parks Section was established within the Parks and Wildlife Service in 1982.

Under a Commonwealth-Queensland agreement, costs for management are shared. Capital costs, such as boats, accommodations and equipment, are met by the Commonwealth for the first three years; running costs, including salaries, rent, fuel and communications, are shared equally by the two governments.

Management by education is the underlying philosophy of the Marine Park. While it is recognized that there must be rules, regulations and penalties, ultimately success will depend upon people genuinely understanding and accepting the need for management and self-regulation in accord with the provisions of zoning and management plans.

Complementing educational programs are surveillance (by air and water), monitoring and—only as a last result—enforcement. Surveillance not only detects infringements, it also builds data on usage patterns and practices. As a sign that the cooperative philosophy is beginning to work, surveillance craft are being recognized more as friendly "eyes in the sky" than as "aerial spies." Enforcement is used only in cases of repeated or serious infringement, with penalties ranging from small fines, for activities such as littering, to heavy fines and even confiscation of boats and equipment for serious infractions.

Education

Both the Authority and Queensland Parks Service undertake educational programs aimed at providing a level of information necessary for the community to appreciate, enjoy and use wisely the Marine Park in perpetuity.

Educational activities are undertaken in schools, teachers' colleges, universities and the general community. Interpretive programs reach the Reef visitors directly, and extension programs are being developed with major user groups, such as commercial and

recreational fishermen, collectors, scientists, tourism operators, and boating and diving organizations.

The emphasis in all these contacts is on inter-action, producing programs that mutually benefit the management agencies and the users. But the problems are enormous: the park may be entered by water or air from hundreds of departure points; people using the park are incredibly diverse in background, habits, and needs. And the store of knowledge upon which to build meaningful educational, interpretive and information programs is still relatively small.

Research

In recent times, reef-related research has been accelerating, yet many decisions must still be made on the basis of incomplete knowledge. Fortunately, these decisions, if made conservatively, can be reviewed as the knowledge base expands.

Recognizing the absolute necessity of additional research, the Authority has been given a major function in undertaking research related to the park. Three broad areas are included:

- Resource Analysis, which involves an inventory of physical, chemical, biological, human and human-built resources, identification of processes and development of predictive models;
- Analysis of Use, which describes and measures the impacts of various uses, analyses their value and economic importance;
- Information Management, to provide data for research, management and education.

Conclusion

Changing patterns of use and community attitudes, increasing knowledge from research, and wisdom derived from experience have characterized the first years of development of Australia's Great Barrier Reef Marine Park. The changing processes which create the reef—and its uses—are being reflected in the management strategies now being adopted.

In recognition of the dynamic nature of the Marine Park concept, zoning plans will be reviewed publicly every five years. The staff developing and caring for the park will actively seek comment, advice and information on the operations of the park; data will be collected and analysed, utilizing sophisticated modern technology. But the emphasis will remain on people—those who manage the park and those who will use, enjoy and appreciate the Great Barrier Reef, now and in perpetuity.

Graham C. Morris is Assistant Executive Officer for the Great Barrier Reef Marine Park Authority

Aerial view of a platform reef in the southern areas of the Great Barrier Reef, supporting two coral cays (Hoskyn Islands). Photo – Great Barrier Reef Marine Park Authority

Lizard Island and its neighboring islets are typical of Great Barrier Reef high or "continental" islands. Lizard, now a Queesland state-managed national park, gained a place in early sailing history when Captain Cooke climbed to its summit in 1770 to locate a passage for his tiny flotilla through the nearly continuous Outer Barrier Reef back to open ocean and ultimately to the Hawaiian Islands, where he was killed. ANPWS photo by Alan Robinson

Gaby Kube

Interpretation in Germany's Visitor Centres

(The following was prepared for presentation to European and American conservationists and park professionals at the International Working Conference held in West Germany in June, 1983.)

If you compare the situation in the German and American visitor centres, you realize that we in our German centres speak mostly about information instead of interpretation. I would like to give you some background about the building of our visitor centre at the Lüneberger Heide, an experimental model in which we have tried to learn the best way to give the people knowledge and insight, not only of the interesting facts about the heath area but also for the problems of a nature protection reserve.

When the nature protection movement started in Germany about 1900, the experts tried to raise comprehension of nature questions and give information in a way that was intended to convey instruction and information as well as pleasure and entertainment. They did not call it nature interpretation, they called it local history information. The teachers were the basis of this movement, and it is easy to understand that teachers again and again played a very important role in this field. In the Lüneberger Heide, for example, the teacher Dageförde worked together with the priest Bode. Long before the Verein Naturschutzpark started its activities here, they founded a Society for a Heath Museum with the aim of informing.

They not only wanted to tell some facts about nature but also to show how people lived in former ages and how they left their mark on the heath. Until a few years ago this was the only way to inform yourself about this or any other region. For many decades in Germany the small museums were the main presenters of nature information. Usually they had a collection of local animals and plants, and sometimes even a diorama, which included a real piece of nature in the exhibition. We have a small bog in our information centre, for example. These activities were not based on a concept; with this type of nature information they were not able to present the idea of nature protection.

Shortly after first World War the great German museums were founded — the Museum König in Bonn and the Senckenberg Museum in Frankfurt. They laid much stress on nature dioramas, making these museums the cradle of nature information.

The Association for the Protection of the German Forest presents nature information in a natural surrounding. After the second World War this Association founded a forest and education workshop which built forest nature trails and forest youth hostels. Here for the first time nature information and education in nature protection were based on a didactic methodic theme of the natural community of the forest.

A second wave to bring nature information into the landscape started with the Association for the Protection of the Waddensea. A system of information centres was created which told about a landscape along the North Sea which was worthy of protection. Parallel to this Association, the Association Jordsand and the German Association for Bird Protection built their information centres. The character of these centres was stimulated by the experiences of the Field Study Centres in England, the visitor centres in the American national parks and the information centres in the Netherlands. That is why nature information in Germany has many roots, not just one.

Nature information today not only has many roots, but also many aims. The growing readiness of the people to work actively for the protection of the environment is a good motivation to evoke responsibility for a natural environment. This responsibility stimulates an agreement on the necessity for legal measures and restrictions in nature protection reserves. In this connection it is especially important to give visitors good knowledge of the problems of the landscape.

In our Lüneberger Heide nature protection reserve, which has the structure of a big recreation area, we have worked out new ways to teach nature protection in our information centres. There are two main points to this conception:

The basic idea is to give short but effective information to the many thousands of visitors who wander (hike) across the Heath every year. This makes it possible for them to wander actively and consciously, understanding what is around them, with readiness to learn the importance of nature protection reserves, and to behave in a suitable way. In the information centre exhibitions the themes are offered in a special way so that visitors can inform themselves on the spot; ecological interrelationships become transparent and the visitors are able to develop a feeling for the landscape.

The second aim is to make visitors sensitive to the modifications of the landscape that have taken place and to agree with the efforts that are being made to protect this man-made landscape.

In all of this planning you must avoid making the people feel they are being educated in their leisure-time. That is why this project is based on the motivation of visitors. Our visitors may be elderly people on a bus tour, students, or members of youth groups. But they all have a common motivation: they want to hike or walk. Therefore the actual exhibition is presented by means of a wander route which is divided into ten stations. This wander route and an explanation of the different stations are presented to the visitors on the first level as an optical-accoustical slide show. To give the visitors the opportunity to get a better impression of this information, they can afterward look at an illuminated table with the photographs and printed explanations about the recommended route. A map of the nature protection reserve with the signed wander route hangs on the wall, and a printed copy of the route is given to the visitors without charge.

(It is also important that a new wander route be worked out each year as the main topic of the exhibition changes. Therefore it remains as interesting for those who come to the Heath regularly as it is for new visitors.)

On their route the visitors can easily find the stations by means of posts bearing the corresponding number. One of our principles in the visitor centre is to show only those objects which the visitors are able to discover out in the landscape. Whenever possible we show original objects but also models, photos or graphics to motivate the visitors. As many objects as possible should be touched and handled. Here we follow the good old pedagogical principle that things you can touch are better remembered. The visitors are guided by a member of the staff of the information centre and they can fill in a work sheet which is specially developed for schools with different methods of questioning related to the exhibited objects. By this means discussions develop, the visitors learn of the problems of the landscape and feel responsible to help solve them. To cover the didactical level you have to pay attention to the following principles:

1. you have to evoke the motivation (to read special literature or to go into special museums);
2. you have to transfer the information in the Centre to the object in the nature to give a positive impression to the wanderers;
3. an important point is a multi-sensual experience: new information is connected with well-known perceptions. The visitors make their discoveries in a looking, tasting, listening and handling way.
4. provide the practical experience with objects. We offer many manual activities for the visitors as a method of giving information.

Therefore nature information is a model in experimental phase to realize the idea of nature protection by nature education for the public. The task of these houses of nature information is not only

Well marked trails, (at left) discretely barricaded by low wooden railings, guide the many visitors who come to "wander" the heath. Natural wooden benches provide resting spots, and unobtrusive litter baskets help keep the area neat. Note the trail marker which refers to a printed guide available at the visitor centre.

The "heideschnucken" (literal translation: heath nibbler) are an ancient breed of sheep that once grazed the heath areas in great numbers, providing food and fiber for the residents. Efforts to restore the breed have been successful, and flocks of these sheep, tended by colorfully garbed shepherds and their dogs, can be seen in the Luneberg Heath nature reserve. Products made from their wool are sold in the area, and the meat is considered a delicacy. These sheep are on display at the visitor centre.

to inform wanderers, but also to be a training centre for societies, associations, adult education courses and schools.

The system of nature information addresses mainly the group of pupils and students. In the beginning of our plannings we asked in surrounding schools how much knowledge the pupils had about the Luneburg Heath and the relations between Heath and nature protection. The result of the inquiry was horrible. This situation is not only representative for the schools in our region but also in most of the German schools. It's a sad fact, but reality; that the German school system is not able to distribute enough knowledge about the importance of nature protection. Therefore the pedagogical aspect of our information house is designed to give complete teaching units and slide-shows about different special topics to the groups of pupils staying in the youth hostels around. These teaching units are developed so that the teachers first introduce the themes theoretically with their pupils at school, the intuitive instruction follows in the information centre where theory becomes practice, and finally the success of the teaching unit is controlled by the teacher back in school.

These tasks have to be fulfilled by a specially trained staff, who must take care of the exhibitions, guide and advise the visitors and work pedagogically with the pupils. This needs a team with people especially interested in nature protection who are able to plan and act on their own. In our information centre this work is done by young draft resisters who do social services.

This connection between nature protection and pedagogy is the basis for a reasonable nature education for public.

The foundation of responsible treatment of nature has to be laid during impressionable years in early childhood and youth. As you know, children have a natural readiness to assume a positive attitude toward the environment and nature. There are two possibilities to encourage this: The first is to develop new directions for teachers' education at University. The second concerns the different federal states who have to give more importance to the aspects of the education of nature protection in their curriculum guide lines. You have to know that in Germany every federal state is sovereign in the field of culture and education.

The responsibility for public education in nature protection cannot only be taken by one side, either the schools or the societies for nature protection. To coordinate pedagogical and professional interests, a central institution for education of nature protection is needed. This institution has to work out projects of nature protection as teaching units with an adequate offer of films, slide-shows etc. and the teachers have to be supplied with didactic-methodic introductions.

In the field of the adult education stress on nature education for public has to be laid on exhibitions in nature information centres, museums, zoological and botanical gardens and on training courses for adults in evening schools and academies for nature conservation.

My experiences show that it is absolutely necessary to bring together the different movements for a more effective nature education for public. That's the only way to fill up the gaps on the field of environmental education.

Finally I want to say that my statement can only refer to the system of nature information as it is practiced here in our nature conservation reserve, Lünberger Heide. We have worked in this field for five years. During this time two main problems have become apparent. At first the success of such a project depends very much on the personal engagement of the draft resisters, who have to identify themselves with this work. The difficulty is that these young men only serve in our information centre for one and a half years. Then the next one begins work, and so on. This time is not long enough to build up a responsible staff.

The second problem is that we have not yet found a good way of controlling the success of our work.

It is not our aim to be in competition with other visitors' centres, especially not with the National Park House in the Bavarian Forest. Our information centres in the Luneberg Heath are models in experimental phase, and the purpose of our project is to build up an effective system of nature information, especially for the nature conservation reserves.

Gaby Kube is a teacher and director of the information centre at Lüneberger Heide nature reserve. This article is adapted from a speech she presented to American and European park leaders in June, 1983.

Photos: Marjorie Corbett, National Parks & Conservation Assn.

Gary B. Wetterburg and *Robert C. Milne*

International Workshop on Environmental Interpretation: Reflection of Trends in Personnel Training

The national park systems of the world have grown dramatically in the past decade. Globally, 2,400 parks and protected areas covering 3.7 million square kilometers now exist in 124 countries. In the past 12 years, approximately twice as many new areas were established as had existed in 1969. This has been accompanied by a corresponding growth and institutionalization of management agencies. The training needs of park and protected areas personnel in those agencies are undergoing continual refinements.

Since 1961, the U.S. National Park Service (USNPS) has maintained an Office of International Affairs to handle the numerous requests for information or technical assistance which are received each year. That office coordinates cooperation with other nations on natural, cultural, and recreational resources management. It also plans and manages orientation and training programs for foreign park and conservation officials, helps U.S. field sites with visitors from other nations, and manages National Park Service responsibilities under international agreements and treaties. Examples of the latter are the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere and the Convention Concerning the Protection of World Cultural and Natural Heritage. Both of these important treaties encourage interchange of conservation techniques and concepts among countries.

USNPS advice historically has been sought regarding traditional aspects of park planning and management; however, shifts in emphasis are becoming apparent as nations develop self-sufficiency in these aspects. Many countries are now implementing a national plan for conservation units; that is, a national strategy for selecting representative parks and protected areas. Likewise, the agencies are increasingly recognizing the need to prepare general management plans for individual units of their park systems. Multidisciplinary teams have been established in some countries which are actively engaged in this planning work.

In the past few years, requests have increased for technical assistance in specific park-related fields such as environmental interpretation. Well over a decade ago, a course on environmental interpretation/education was instituted, with international assistance, as part of the curriculum at the College of African Wildlife Management at Mweka, Tanzania. In 1980, Dr. Arturo Tarak, Associate Director of the Argentine National Park Service (ANPS) invited USNPS collaboration in designing and executing environmental interpretation training courses for park rangers at the ANPS Training Center in Nahuel Huapi National Park. In 1981, the Center for Tropical Agricultural Research and Training (CATIE) in Costa Rica sponsored a Central American Workshop on Environmental Interpretation and Education. CATIE requested a USNPS instructor as part of the Workshop staff. The course attracted participants from five countries and included field work in Costa Rica's Manuel Antonio National Park. In 1983, an environmental interpretation workship was cosponsored in Paraguay by three government ministries, a national conservation organization (PRONATURA), the Mayor's office of Asuncion, the U.S. Peace Corps, and the USNPS. Thirty-five participants were introduced to interpretive techniques and developed action plans for use in their respective agencies. Such efforts, in a variety of countries, are a result of a combination of factors, particularly a desire to gain public and governmental support as well as to consolidate recent gains in establishing new areas and management agencies.

Other training needs are more subtle but nonetheless expected to grow. These include program topics such as: park resource management and protection, research and monitoring appropriate to national parks, park related tourism and public relations, park maintenance, guidelines for management of World Heritage Sites and Biosphere Reserves, and national parks as a component of economic development. These observations generally agree with training assessments made by IUCN (1983), Miller (1972), and WWF-U.S. (1980).

In 1982, a 2-week Spanish language International Workshop on Environmental Interpretation was initiated at Harpers Ferry, West Virginia to help fill the requests made to the USNPS, and as a complement to the Central American course. It utilized written materials developed by CATIE which were blended together with a training course outline prepared and used by NPS naturalist J. Douglas Cuillard in Argentina the previous year. The Workshop was held in both 1982 and 1983 at the USNPS Mather Training Center in Harpers Ferry on an experimental basis. Participants included 26 individuals from 15 countries.

The Workshop drew upon NPS experience with the highly successful International Seminar on National Parks and Equivalent Reserves which has been conducted for nearly 20 years and is cosponsored with Parks Canada and The University of Michigan. The International Seminar is offered in English only and is designed for those who occupy the senior management positions in their countries' park systems. The Workshop, offered in Spanish, was designed for those either directly involved with environmental interpretation or else with setting up the administrative divisions which would execute these functions.

The International Workshop on Environmental Interpretation was introduced to share NPS experience in this field with the idea that some of the techniques and concepts which have proven successful in the USA may be adaptable to other cultural situa-

David Wright, Associate Director, US National Park Service, (far right) welcomes participants to the opening session of the international seminar. Gary Wetterberg (to Wright's left), NPS Office of International Affairs, translates into Spanish.

tions. This point was stressed continually throughout the sessions. The participants were urged to consider what they observed during the course in relation to their own varied cultural backgrounds. They were also encouraged to exchange information freely among themselves about the environmental interpretation techniques, policies and procedures utilized in their own countries.

The workshop had the goals of providing wildland managers with: (1) an introduction to environmental interpretation consisting of concepts and practical information which could be adapted for use in the parks and protected areas of their respective countries; and (2) an international forum for mutual interchange of environmental interpretation concepts and techniques currently employed.

The objectives of the Workshop were that, upon completion, each participant would be able to:

1. Define environmental interpretation in their own terms and discuss its role in the management of their parks and protected areas.
2. List and discuss principles of interpretation.
3. Write precise, measurable objectives for interpretive programs.
4. Identify benefits of interpretation within the context of their own countries.
5. Distinguish between environmental interpretation and environmental education.
6. Describe a suitable format for an interpretive plan within their own national context and its relation to a general management plan.
7. Identify various interpretive programs, media, and techniques which would be most effective according to the particular characteristics of their own home countries.

The technical content of the course included: definitions and principles of environmental interpretation; analysis of visitor expectations; mechanics of interpretation; personalized and nonpersonalized services; strategies of questioning, structure and response; and techniques for effective interpretation. Field trips included visits to Catoctin Mountain Park, Shenandoah National Park, Gettysburg National Military Park, and Harpers Ferry Historical Park. Special tours were also arranged of the Harpers Ferry Center.

Participants gave presentations to introduce their own parks or protected areas to each other and to the staff. Toward the end of the course, two groups were formed, and each was asked to draft a preliminary interpretive plan for a park selected from among those nations represented. The Workshops were then evaluated in relation to their stated objectives and other factors including suggested additions or deletions.

The 1982 Workshop was subsidized by the USNPS on a trial basis. This prototype was highly regarded by participants who suggested that demand would probably be sufficient for the course to achieve financial self-sustainability. In 1983, thanks to the financial support of various national governments, the Organization of American States, the U. S. Agency for International Development, The U. S. Fish and Wildlife Service, FAO, UNESCO, and particularly the World Wildlife Fund-U. S., the USNPS was able to select 14 highly qualified applicants from 14 different countries. Six potential participants, with assured or likely funding, had to be turned down because of lack of available space.

The evaluations of the Workshop praised its content and mix of field work with classroom exercises. One participant noted,

> "... having completed the course, I now have tools and new knowledge in interpretation which can be used advantageously in my country. I furthermore can see clearly opportunities which are being lost in some of our parks..."

However, preoccupations were expressed about the comparatively sophisticated level of techniques and materials utilized in the USA, and the lack of time to attain proficiency in basic hands-on skills such as sign making, slide labeling, and brochure layout. Participants suggested that materials and equipment used in the USA often would not be possible within the park budgets of

many developing countries. Furthermore, while experience suggests that funding is not a major problem if the course is planned well enough in advance, expenses could probably be cut in half by holding the Workshop in a site more centrally located for the intended audience. Because of these reasons, the USNPS has decided not to hold the Workshop again in the US, but rather, to encourage and participate in its realization in Latin America. Both CATIE in Costa Rica and the Argentine National Park Service have expressed interest in assuming responsibility for the Workshop in their respective geographical regions.

Workshops and courses of this nature, dealing with discrete technical topics which meet the evolving needs of park and protected area personnel in the 1980s, are well worth considering by regional development agencies and academic institutions. They may be used to impart new skills or as refresher courses. They could be taught in whatever language is applicable, and organized on a biogeographical basis. The best available expertise should be utilized to develop the training module which then could be transferred elsewhere with apropriate modifications.

Photos: National Park Service

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Robert C. Milne, Chief of International Park Affairs of the National Park Service in Washington, D.C., is Vice Chairman for the Nearctic Realm for the Commission on National Parks and Protected Areas of the IUCN. Dr. Gary B. Wetterberg, worked for FAO for several years in South America and is the Western Hemisphere Program Coordinator for the NPS. He is a Consultant to IUCN's Parks Commission.

(left to right) Yolanda Maldonado, manager of the NPS Hispanic program, talks with Soledad de Moreno, specialist in environmental education for Soberania National Park, Panama; Silvino Gonzalez, superintendent of Defensores del Chao National Park, Paraguay; and Constanza Casasnovas, chief of environmental education for the national park system of the Dominican Republic.

Stephen H. DeBenedetti
and David J. Parsons

Protecting Mountain Meadows: A Grazing Management Plan

For more than a century, pack and saddle stock (primarily horses and mules) have been used in the western United States for recreation and as a management tool. Today, most large western parks continue to permit the use of these animals for both purposes. The character of such use, as well as the management restrictions governing it, vary with the history of the area. In Glacier and Rocky Mountain national parks stock are required either to use corrals or hitchrails or to be tethered in designated areas. In addition, all stock feed must be carried into these parks. In Yellowstone, stock are allowed to graze from picket lines in designated meadows that are rotationally rested depending on conditions. In California's Sierran parks, grazing by free-roaming animals generally is permitted. In Yosemite, stock parties are requested, but not required, to carry feed. In Sequoia and Kings Canyon, grazing by free-roaming stock is the norm.

Impacts caused by stock use are primarily a function of the timing, frequency, and intensity of use. Impacts result both from herbage removal (grazing) and trampling. Grazing occurs primarily in meadow or other forage areas; trampling effects can be found associated with meadows, trails, or camps. The susceptibility of individual plant species as well as moisture conditions and phenological stage must be considered in evaluating the potential for such impacts. Behavior of the stock and control exerted by the packers also influence stock-use impacts.

Given the decision (whether for historical, political, or other reasons) that pack and saddle stock use is to be permitted, it becomes the responsibility of park management to determine what levels of use and impact are acceptable. For example, grazing management policies should aim to minimize adverse impacts to meadow ecosystems. This generally means that the timing, frequency, intensity, and nature of stock use may need to be controlled. However, informed decisions on what specific restrictions should be enforced depend on knowledge about the effects of different use patterns and practices.

Private and commercial stock use has been common for nearly a century on much of the land now within Sequoia and Kings Canyon national parks. Recreational stock use peaked in the mid-1930s when 72 commercial outfitters operated in the southern Sierra Nevada. Dependence on stock now is associated with only about 6 percent of total backcountry visitor nights. Nevertheless, at least 16 commercial pack stations currently operate in the parks. Commercial, private, and National Park Service administrative use now account for approximately 11,500 nights spent in the parks by stock each year.

Since 1941, the National Park Service has conducted a series of qualitative surveys of meadow conditions in the southern Sierra Nevada. Reduction of vegetative cover, gullying and erosion, and the invasion of lodgepole pine and "weedy" species were identified as serious impacts probably dating back to the late 1800s. Together with later surveys, this information provided the basis for a grazing management program that has continued to the present and includes closing certain areas to grazing, restricting opening dates, and limiting the number of animals and length of stay. Management actions generally have been implemented on a case-by-case basis, often only after the impacts have occurred. Together with evidence that subtle changes in species composition, abundance, and plant vigor have occurred with grazing, this has led park managers to identify the need for more quantitative data on the impacts of grazing activities. Such data would permit the development of a grazing management plan that is both predictive and responsive to on-site conditions.

Development of the Plan

The first step is to establish management objectives. The objective for grazing management in Sequoia and Kings Canyon is to allow free-roaming grazing by commercial, private, and administrative stock, provided that:

(1) continuous undirectional change in plant composition and/or vigor (productivity) does not result,

(2) the sod or soil does not become increasingly erodable, discontinuous, irregular, and

(3) a network of meadows representative of each major type is protected from all stock use so that they remain as near to naturally functioning ecosystems as possible.

Other steps required in developing such a plan include a decision on the type of management system to be utilized and the development of a scientific data base on the effects of various grazing practices. In Sequoia and Kings Canyon, it was decided that the primary management tool would be a system of opening dates that would vary, depending on the type of hydrologic year and the vegetation and soils of the meadow in question. Additional restrictions, including closures or limits on number of head or duration of stay, would be utilized only on a meadow by meadow basis. Such restrictions might be based on total forage removed or the stage of development at which key species are grazed.

To meet the established objective, the Grazing Management Plan must provide a flexible system that (1) is sensitive to annual variation in climate, (2) considers the nature of specific meadows, and (3) is sensitive to the inherent ability of individual species to withstand grazing and trampling. Also essential is a monitoring program. The Plan must be sufficiently predictive to prescribe

opening dates for specific forage areas in time for commercial operators to book their trips. The involvement of user representatives in the planning process adds greatly to the potential for compliance and acceptance.

Background Research

To develop a grazing management plan for Sequoia and Kings Canyon national parks, a 5-year research project was undertaken in 1973 aimed at understanding the composition, distribution, and susceptibility to impact of the parks' major forage areas. The vegetation of each of these areas was described in sufficient detail to estimate the contribution of different plant communities to the total meadow acreage. A forage area was defined as a meadow or series of meadows and the dispersed forage in between that free-roaming stock would utilize when turned loose overnight from adjacent camp areas.

High-elevation meadows in the Sierra generally consist of a series of species groups, or plant associations, each with distinct characteristics (phenology, soil moisture, retention productivity, etc.) and tolerances to grazing and trampling. Such associations may be spatially distinct from one another (as along an elevation gradient), or they may be interspersed in a mosaic pattern, responding to such local environmental differences as surface irregularity. In the former case, animal behavior is often such that more sensitive areas may be avoided if preferred forage is available, for instance, in drier areas. In the latter case, animals often cannot avoid trampling the more sensitive areas. The potential for avoiding sensitive vegetation must be estimated for each forage area as the vegetation is classified.

In our study we looked at total productivity and phenology in conjunction with the effects of simulated grazing (clipping) on selected plant associations. The intensity (degree to which a plant is grazed), timing (stage of phenological development at time of grazing), frequency (number of times grazed during a season), and periodicity (pattern of grazing from year to year) of herbage removal have different effects on different species and, thus, on different associations.

Since it was not possible to test experimentally all of the potential combinations of these factors, we chose to look only at intense herbage removal (within 2.5 cm of the root crown or surface, whichever was higher). The timing of herbage removal was varied with calendar date, while frequency of grazing was simulated by clipping one, two, or three times during the growing season and again at senescence.

In all, we tested four clipping patterns, plus a control, for each of six plant associations. Treatments were repeated for four successive years to simulate severe repeated pressure. In the fifth year, recovery of the clipped plots was measured. The most important plant associations were replicated at several points along a 1,200 meter elevational gradient to evaluate the effect of elevation.

Results have provided us with basic knowledge of the annual fluctuations in productivity of the major plant associations present in the parks' subalpine and alpine meadows. Response of the most important associations to sustained multiple clippings also has been determined. Thus, the effect of different levels of herbage removal can be predicted and capacities (in animal nights) can be predicted.

Trampling also may have significant impacts on meadow vegetation, in the form of direct injury or mortality or as indirect changes in composition of the kind that occur when surface moisture patterns or soil stability is altered. The parks' objective has been to minimize the potential for changes in composition due to trampling by minimizing potential disturbances of the surface soil and sod. To accomplish this, moisture conditions were monitored in key plant associations on a regular basis (every 7 to 10 days) from mid-June through August, 1978-1981. In addition, the degree, extent, and type of mechanical impact, if present, was described and correlated to the moisture conditions. This provided a predictive index of susceptibility to trampling by specific plant associations under differing moisture conditions. Such information provides the basis for estimating opening dates that minimize mechanical disturbance of the surface soil and vegetation.

Three important types of easily recognizable mechanical impacts observed were: (1) broken sod, which includes the imprinting, gouging, tearing, or shearing of the soil-vegetation complex, occurring most often when the surface soil is wet or moist; (2) scuffing, including the slicing or abrasive removal of aerial vegetation, occurring in mesic or drier sites; and (3) pulverization, the fragmentation or disintegration of the soil pedestal or soil-vegetation complex that occurs with severe trampling, most commonly under xeric conditions where vegetation is discontinuous.

While we feel the occurrence of broken sod can be minimized by means of adjusting opening dates according to moisture conditions, closer monitoring and additional restrictions may be necessary if pulverization or scuffing levels are considered unacceptable.

Implementation of the Plan

Once the manager has information concerning the activity patterns of grazing animals, the composition of individual forage areas, the productivity of different plant associations, their responses to different herbage removal patterns, and their moisture regimes and susceptibility to mechanical impact, the tools are available to develop use prescriptions for individual forage areas that will have predictable results. The next step is to choose the degree, type, and extent of impact acceptable and adjust the intensity, timing, frequency, and periodicity of use accordingly. For example, a given forage area would have a specific opening date and may have limits on total stock nights, either for the year or at any one time. These restrictions may vary depending on whether it is a wet, dry, or normal hydrologic year.

The grazing management system will succeed only if it can be understood by those who must use and enforce it. In Sequoia and Kings Canyon, opening dates are now prescribed for three types of hydrological years (wet, normal, and dry); thus it is possible for the user to know well in advance the opening dates for specific forage areas.

Once acceptable use prescriptions have been generated, the manager may find it necessary to ration or allocate use in strategically located or popular forage areas. Available options include head limits, length of stay limits, and scheduled closure periods.

Where levels or patterns of use are potentially unacceptable, it is necessary to develop an effective use-monitoring scheme. If biomass removal or the percent of preferred plants grazed is used to define acceptable use levels, either direct measurement of these factors, or estimates based on the number of stock days occurring must be utilized. Because of manpower shortages, in Sequoia and Kings Canyon we have developed an extensive use-monitoring system as an alternative to direct measurement. Administrative, commercial, and private stock parties are required to file an itinerary on completion of each trip. More than 90 percent of all stock use now is accurately reported.

As a final, important phase in our Grazing Management Plan, it has been determined that a network of meadows representative of the major types found in the parks will be protected from all stock

Pack horses grazing in Cyclone Meadow, Sequoia National Park, California. Grazing management plans assure that the natural environment in the parks is not damaged by overgrazing from domestic stock. Photo: National Park Service

use. These natural functioning ecosystems have been selected so as to minimize inconveniences to users and to include as many remote areas as possible.

In summary, a grazing management system for free-roaming stock in western US national parks must be based on clearly defined objectives and standards of acceptable impact. The vegetation and surface characteristics of each important forage area must be inventoried and response of specific plant associations to grazing and trampling known. Animal preferences and behavior may be important and should be evaluated. User characteristics and patterns in specific forage areas should be analyzed in order to develop the most appropriate management strategy where overuse might occur. A use-monitoring system also must be developed. The involvement of user groups in the planning process improves communications and assures that the manager has a clear understanding of the user perspective.

David Parsons is a research scientist and Stephen DeBenedetti is a biological technician at Sequoia-Kings Canyon National Park, California, USA. This article is reprinted from Park Science, *Spring 1983.*

PARK TECHNIQUES

Trail Construction

In most national parks it is generally impractical and undesirable to develop extensive foot trails of an elaborate nature. Simple but well marked tracks through wild country, or hardened paths for routine occasional use by men and horses normally will serve their purposes quite adequately.

There are, however, certain trail locations where development to a fairly high uniform standard should be considered. Park managers will quickly identify these locations as those where heavy and usually short-distance use is normal—as between an auto parking area and a popular overlook, for example. Well constructed trails will be safer to use, and usable by more people. They will provide better protection of the areas crossed and require less maintenance. Ideally, these trails should look as if they had always been there, an integral part of the landscape.

It is always a wise precaution to review proposals for any development where excavation and construction are involved with experts who can assess the possible effects of the planned work on the environment. Where damage may occur to wildlife and its habitat, to historical or archaeological areas, to special botanical values, or to other irreplacable resources, the planned project should, of course, be cancelled or modified to preclude such unacceptable impacts.

The following notes, drawings and guidelines on the design and construction of trails were adapted by the editors for PARKS Magazine from the Park Practice Program publication, *Design,* issued for the last quarter of 1975. These remarks apply primarily to temperate regions.

A basic step in constructing a trail is to "line out" or mark the width along the path from start to finish. See sketch 1. Both sides of the planned trail should be staked, the distance between them depending on the steepness of the land and anticipated uses. On hillsides with one-to-one slopes, or slopes of steeper grades, a good width on solid earth would be about 1.25 m (4 feet). See sketch 2. Where no slope exists, line out in accordance with sketch 3.

Stakes should be well-placed so that there is no question about where the trail is to be cleared and excavated. This is particularly important on curves. When the entire trail has been staked you can begin to clear the area of brush and small trees, but remove only those which absolutely must be sacrificed for the minimum recommended trail width.

As for the linear grade of the trail, about 15 percent should be regarded as the maximum.

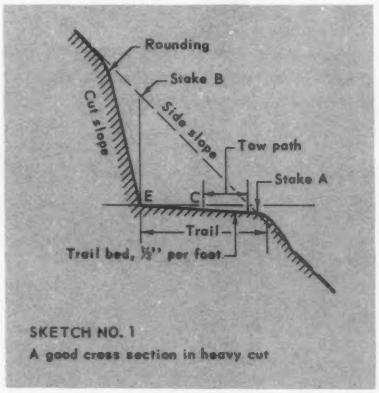
If handicapped or elderly people are expected to use the trail, gentler grades of no more than 5 percent should be used, and there should be no obstacles such as stairs, stumps or other impediments. Rest areas with places to sit should also be installed at intervals.

Excavation

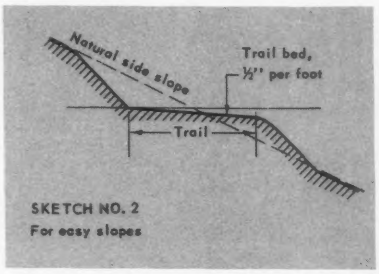
A narrow work path is cleared along the line formed by the outside stakes and excavated back about 50 cm (18 inches). See sketch 1. This path establishes the line for excavation of the remainder of the trail and its grade. If alterations need to be made, less time is lost and less damage done than if the entire trail were graded. The next step is to excavate to the full width.

The slope of the banks must then be considered. See sketch 4. The top of the slope, point "E," should be marked or staked on the ground and the slope cut straight from "E" to "G." The slope below the trail is then finished with fill and feathered down to the natural grade.

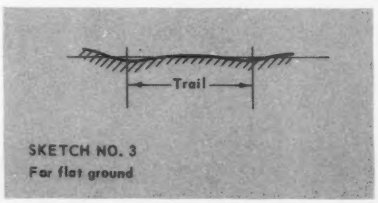
There are two primary objects in sloping banks: (1) it is a particular aid to the control of erosion in that it establishes slopes that are more nearly natural, thus enabling vegetation to catch quickly and cover the new cut and fill surfaces; (2) it reduces the possibility of damage through the action of frost and rain. Sketch 5 shows the action of frost on a poorly constructed trail. The combined action of water and frost at "A" and "B" loosens the material which drops to the trail, in some cases to such an extent that the trail becomes impassable.



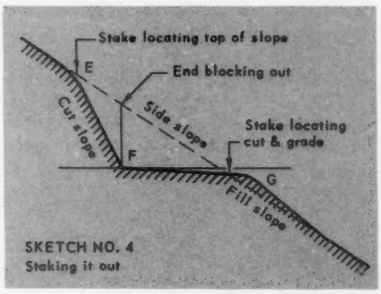
SKETCH NO. 1
A good cross section in heavy cut



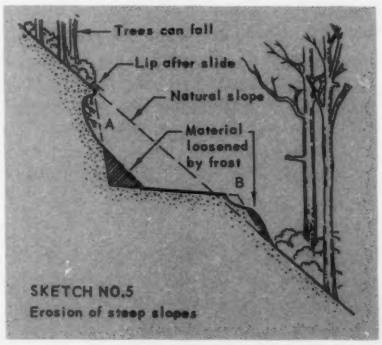
SKETCH NO. 2
For easy slopes



SKETCH NO. 3
For flat ground



SKETCH NO. 4
Staking it out

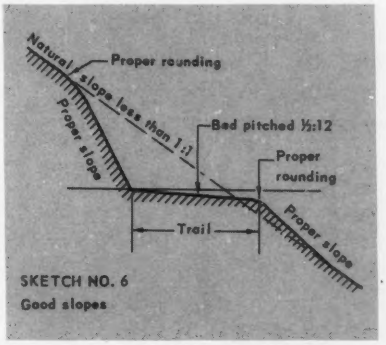


SKETCH NO.5
Erosion of steep slopes

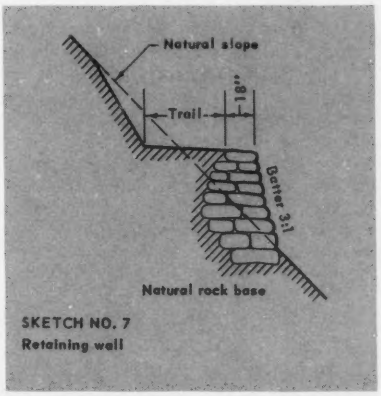
Sketch 6 illustrates an ideal trail section, well finished, with banks and trail surfaces properly sloped and corners of cuts and fills properly rounded.

The question of how far to cut back a slope (or bank) is often a problem. Where the trail crosses a gently sloping hillside the bank may be taken back on a 2-to-1 slope, that is, 60 cm back for each 30 cm in height. A 1.5-to-1 slope is good, and a 1-to-1 slope should be regarded as the maximum, although there may be exceptions. Care should be taken not to remove too much established plant growth by grading too far up steep banks.

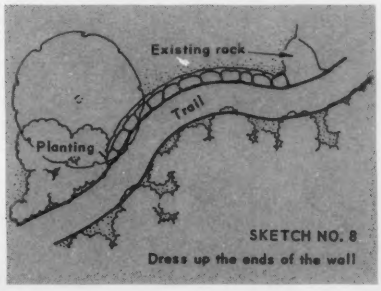
It is sometimes difficult to keep a slope uniform along the trail when the bank varies in height. If the slope is to be 2-to-1, measure the height of the bank, then measure back twice this distance from the vertical face of the cut, and set your slope stake. These stakes should be set from 1.5 to 3 metres apart to maintain a smooth, uniform slope.



SKETCH NO. 6
Good slopes



SKETCH NO. 7
Retaining wall



SKETCH NO. 8
Dress up the ends of the wall

Wall Construction

A natural slope is preferable to wall construction but walls are necessary in many situations. Great care should be taken in their construction. See sketch 7. To assure solid construction and good appearance the following rules should be followed in the selection and setting of rock. Start the construction with proportionately larger rock at the bottom of the wall; grade the size to smaller rock in the center section and again increase the size toward the top of the wall. The top course of the wall should be of rock sufficiently large to be solid. The following method of wall construction has been used with good results.

1. The outside edge of the base of the wall is carefully staked along the route of the trail.

2. Vertical batter boards as a guide to the slope of the wall during construction are set at intervals along this line at the proper slope. It has been found advisable to allow about 5 cm (2 inches) of clearance between the batter board and the wall surface. Care should be taken in placing the batter boards to see that the top of the wall is located to give the proper width of trail when the job is finished.

3. After the batter boards are set, excavation is started. Wherever possible, walls should be built on a natural rock foundation; if this is not present, excavation should be made to solid earth, below the frost line, before any wall construction is begun. Never build walls on filled earth bases.

4. Where the trail is built on earth-fill back of the rock wall, the wall should be built to the following dimensions: the base of the wall should equal one-half of the height. The front face of the wall should be battered about 23 cm (9 inches) to the metre (39 inches) in all cases. The back of the wall should be built in steps starting at the bottom and finishing at the last course with a width of wall at least 45 cm (18 inches). See sketch 7.

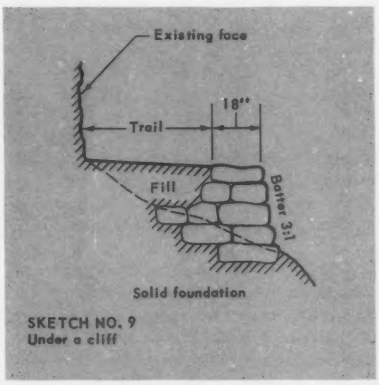
5. Particular care should be given to locating the beginning and ending of the wall. Wherever possible the wall should begin and end in some natural formation, leaving no sharp ends exposed above the natural surface. Where this is not possible, arrangements should be made for planting with native materials to obliterate the ends of the wall, as in sketch 8.

Sketch 9 shows a typical walled section where the entire trail width is obtained without going into the side slope and creating a large scar. This is particularly useful in very steep hillsides and in places where outcroppings of rock must be avoided.

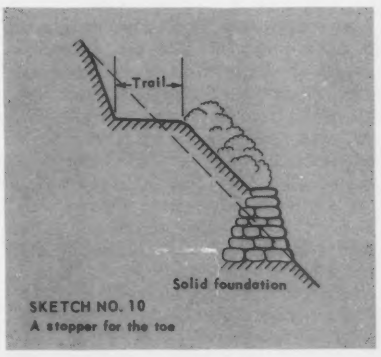
Sketch 10 illustrates a type of wall used where it is necessary to drop below the line of the trail to find firm foundations for wall construction. The slope between the top of the wall and the trail grade is built similar to the fill slope on the trail in ordinary circumstances. Care should be taken to provide for drainage above the wall.

Sketch 11 indicates a type of wall that is not practical as it can be washed out or turned over by frost action. It is merely a rock veneer and cannot be depended upon to retain a fill where there is pressure against it.

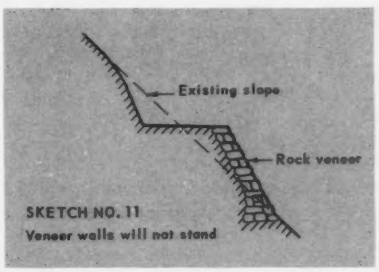
Sketch 12 indicates a wall on the cut side of the trail serving to retain loose earth and rock above the trail floor. This may be justified in a few exceptional cases. As a rule, however, wall construction above the bed of the trail should be avoided, as well as any laid-up work above a



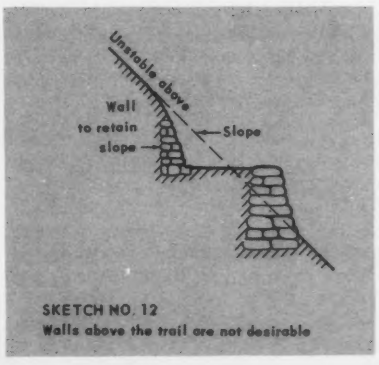
SKETCH NO. 9
Under a cliff



SKETCH NO. 10
A stopper for the toe



SKETCH NO. 11
Veneer walls will not stand



SKETCH NO. 12
Walls above the trail are not desirable

trail such as veneer construction to eliminate a hole in the upper bank where a stump has been removed. Where it is necessary to stabilize a bank above a trail it may be done by placing the rock in such a manner that it gives the appearance of a natural outcropping. This area should be planted in a natural manner, using native plant materials, down to the trail edge.

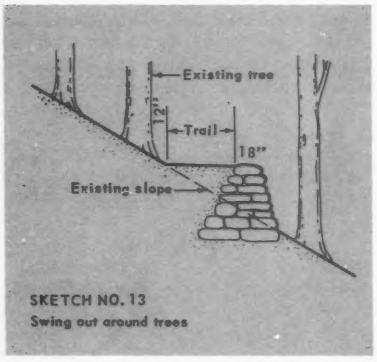
Where trails pass close to large trees and the location is kept below the tree, the type of construction shown in Sketch 13 should be adopted. This will make it possible to build the trail to the proper grade and location without injury to the tree roots.

Trail Width

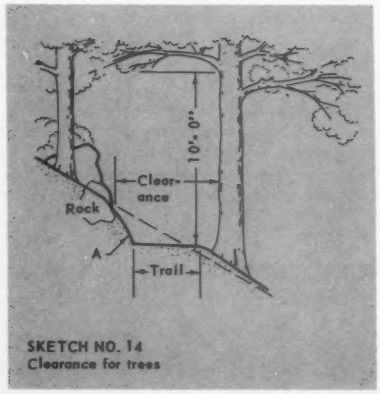
The anticipated intensity of use will determine the required trail width, of course, but 1.25 m (4 feet) is probably adequate for most trails. This width should not be measured out to a sharp edge which is not substantial. It should be measured from the outside of the trail where the fill slope starts to round over, to a point just out from the base of the cut slope, allowing for rounding out at point "A". See sketch 14.

Where there is a wall on the lower side of the trail, the width should be measured from the inside of the wall. The top of the wall should not be included in the width of trail.

Where there is a steep dangerous dropoff below the trail, the trail width should be increased to 2 or 2.5 m (7 or 8 feet), exclusive of wall width. If pack animals or horses are permitted on the trail there should be at least 30 cm (1 foot) clearance beyond each side of the trail. This distance may be increased where there is a dangerous condition below the trail. Tree branches that overhang the trail should be removed to permit passage of horseback riders. See sketch 14.



SKETCH NO. 13
Swing out around trees



SKETCH NO. 14
Clearance for trees

Drainage

No factor in trail construction is more important than proper drainage. Many sections of good trail are damaged and destroyed by erosion which could have been prevented. All drainage should be planned well ahead of construction. The method of carrying surface water off of each trail section should be determined, along with the location, type, size, and construction details of all drainage structures.

Three general drainage conditions are encountered in trail construction: **sheet water, water concentrating in natural basins, side drainage,** and **water in natural channels.**

Sheet water. Where water comes to a level section of the trail from an uphill slope it usually does not concentrate in drainage channels, but flows across in a sheet. In rare cases it is permissible to concentrate sheet water by cutting hidden ditches across the hillside, with an open ditch bringing the water to a culvert under the trail. *The approved practice is to pitch or tilt the trail bed* about 4 cm to the meter (½ inch per foot) so as to carry sheet water across the surface with the least concentration, and thus with the least danger of erosion.

Water concentrating in natural basins. Foot trails may go uphill and down, or cross ridges which shed water, and hollows which collect it. These hollows may concentrate water from a considerable area. The bottoms of these hollows, touching the trail, may be flat and wide, or steep and narrow. This topography calls for drainage structures, and the shape and area of a hollow dictate their location, type and size.

Surface water should not be forced to concentrate in channels to a greater extent than it does naturally. To compel it to back up behind culverts in new locations is to invite destructive erosion and unsightly ditches. Several small culverts should be used rather than one large one. The trail should also be raised enough to impound a rush of storm water until it can flow through the culverts, without cutting new channels in the drainage basin or across the trail.

In gullies, nature has already determined the type of structure to be employed, a culvert big enough to carry all the water that comes down. The gully has already established a temporary balance between the scour of the stream and its bed. This balance should not be disturbed, so the floor of the culvert should be at the level of the gully bed. Then the elevation of the trail, compared with the elevation of the gully bed, may dictate a wide, shallow culvert, or a deep, narrow one. But the wider the culvert the easier it will take water, and the less danger there will be of destructive cutting on the discharge side.

In many places where a small culvert seems to be needed it might be better to build a low-water crossing, which is merely a depressed section of the trail paved with flat stones.

Side drainage. Sometimes it is necessary to drain a trail surface to the inside, against a bank, providing a catch basin at the end of the culvert. Draining a surface in this way should be avoided if possible, but where it is necessary the side ditches should be paved with flat stones to prevent undermining. See sketch 15.

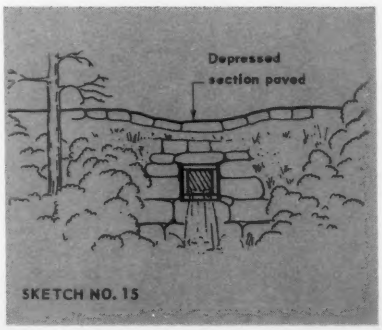
The only particular requirement for this type of culvert is to carry the catch basin well into the bank to keep it away from traffic. The back wall of the catch basin should be carried far enough up the slope to prevent erosion around it.

Water in natural channels. Established channels determine the location of culverts, and the amount of water to be moved can be estimated with reasonable accuracy. Any depression, even one coming from a small spring, is the established drainage channel in that area. This can be proved by the absence of erosion and the presence of cover on nearby surfaces. The amount of run-off at flood stage can be estimated by lines of drift left by high water, scouring at the bases of trees, root systems exposed by scouring, and other signs.

The culvert must be large enough to carry flood water, and its floor must be at the level of the channel bed. These two factors determine the size and shape of the structure. Where there is any choice, the culvert should be wide rather than deep. In some situations a bridge rather than a culvert will be required, but bridge construction cannot be treated in this brief article.

If the drained slopes are bare, and erosion is to be retarded until cover grows, a catch basin can be built at the intake end of the culvert, with dry walls built high enough to form an impounding basin behind them, where the flood water can deposit its silt before seeping into the culvert. But in such a case special care must be taken to protect the culvert with wing walls, so that impounded water will not find a passage along the walls of the structure and eventually wash out the trail.

Types of culverts. Culverts may be preformed of concrete or steel, or made of timber, or stone using dry or mortar joints as prescribed by plans, general instructions or local conditions. In stone construction the end of the walls should be flared, as a usual practice, to hold the fill above and to prevent scouring by flood water. Care should be taken to keep inside surfaces uniform and smooth to prevent debris from



SKETCH NO. 15

catching. A culvert should extend 50 cm or so (a foot or two) beyond the edge of the trail on each side, and the trail widened to the head walls of the culvert. The bottom level of the culvert should slope downward along its length not less than 1 cm in 30 (⅜ inch to the foot).

Waterbreaks

A waterbreak placed at intervals across trails should be extended far enough into the bank on the upper side of the trail to prevent water from cutting around it. It may be necessary to cut a notch into the bank to accomplish this, tamping the dirt back afterward. Both ends should be anchored behind rocks or trees, or firmly staked in place. See sketch 16.

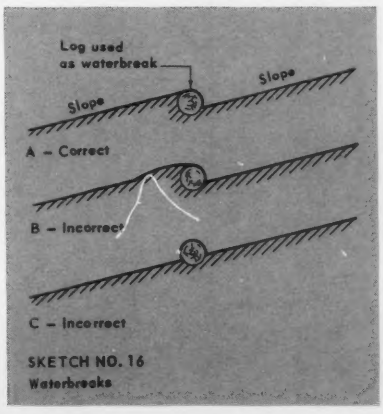
The pitch of a waterbreak, or the angle at which it lies across the trail, is very important. A definite relation between the slope of the trail and the pitch of the waterbreak must be established by experience in each location. This relation depends upon the nature of the soil, and it may vary greatly on different sections of the trail. On one section there may be a stiff clay which does not wash. On another stretch there may be alluvial soil which will wash badly.

As one of two extremes, take a section in tough clay on a flat slope. Here there is very little danger of washing, and the breaker can lie on a steep pitch carrying off all of the water quickly. If it were laid on a flatter pitch, there would be danger of silt depositing behind the breaker which would put it out of use.

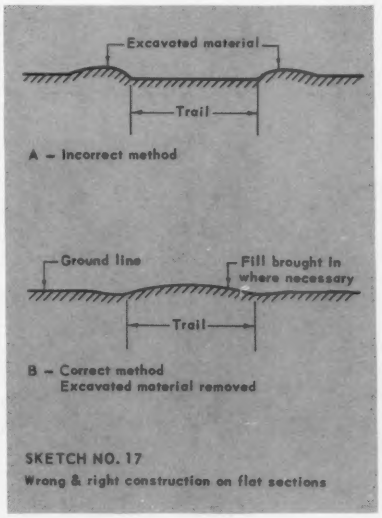
At the other extreme, consider a section in alluvial soil on a steep slope. Washing will occur here on the slightest incline, so the breaker must lie almost straight across the trail. If it is given a more pronounced pitch the water will hit the breaker, turn, and wash a cross-ditch. The breaker log may be washed out too, and the water will go on down the trail, making an additional load for the next breaker to carry off.

The spacing of breakers cannot be determined by any rule, but there are three particular locations where they should be placed: (1) where there is a depression or wash, the breaker should be set below; (2) on sharp curves, the breaker should be set at the uphill entrance of the curve; and (3) at changes in the trail grade, the breaker should be set just above the break in grade.

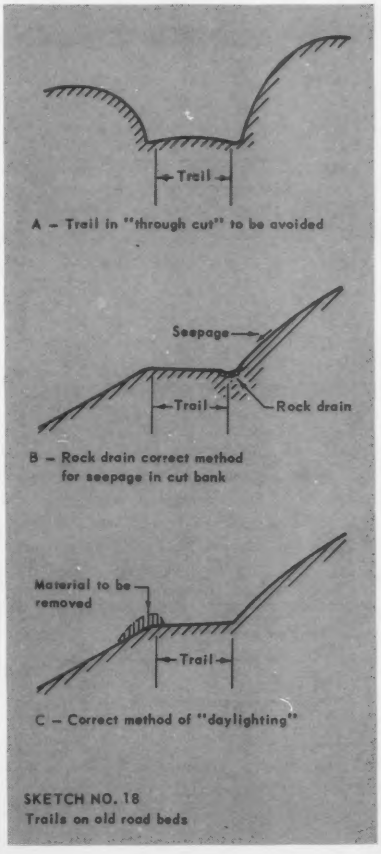
No harm is done if some excess water goes over a breaker that is carrying a full load off to the side. It is better to set them so that this occurs in heavy downpours than to pitch the breakers so that excessive scouring occurs alongside the logs. If careful study is given to the behavior of breakers in different soils, and on different slopes, it will be possible to reach a reasonable balance between scouring, as one extreme, and silting up, as the other.



SKETCH NO. 16
Waterbreaks



SKETCH NO. 17
Wrong & right construction on flat sections


Trail
A – Trail in "through cut" to be avoided
Seepage
Trail
Rock drain
B – Rock drain correct method for seepage in cut bank
Material to be removed
Trail
C – Correct method of "daylighting"
SKETCH NO. 18
Trails on old road beds

In sketch 16, "A", "B", and "C" indicate three methods of setting breakers. "A" is the correct method with the grade below the breaker finishing flush with the top of the log. When setting, it is better to fill rather full back of the breaker and then tamp the soil well to prevent settling and the consequent exposure of the breaker. The grade above and below the breaker should feather nicely into the grade of the trail and not leave a "bump" as shown in "B". When breakers are set in this manner they are secure and not visible when one looks up the trail.

"C" indicates a method which is not desirable. It is not as secure, is more noticeable and creates an obstruction to stumble over.

The following are frequently encountered conditions that require careful study to secure proper drainage.

On ground where there is no appreciable cross slope, the trails often are incorrectly built as shown in "A" of sketch 17. Turf is cut from the trail floor and raked off to the sides, making piles that confine water to the trail and wash it out. On such locations, the proper method of construction will usually be to work out shallow, rounded depressions, not ditches, at the sides, and the good soil from these excavations used to slightly raise the level of the trail forming a dry, well drained surface in wet weather. In some cases it will be necessary to gather additional fill from another section to raise the trail floor. Drawing "B" in sketch 17 indicates the correct method of construction in this type of topography.

Water should be directed away from these drainage depressions wherever conditions will permit.

Sketch 18 indicates types of construction used when trails follow old road or railroad grades.

"A" — This sketch indicates the method used in "through cut" sections. It is not a desirable solution, however, and should be avoided wherever possible.

"B" — This shows a condition frequently encountered where there is a seepage of water for some distance from the bank above the trail which will keep the trail continually wet if the water is not disposed of satisfactorily. Here the trail is raised and the seepage caught in a rock fill which should extend along the trail for the distance that the seepage exists, and from there connect with one or more culverts.

Mounds of earth similar to those shown in "C" should be graded off.

Securing Firm Trail Foundation

Trails should not be built on top of peat or beds of leaf mold. When this condition is encountered the entire depth of soft material should be excavated to make a solid base that is well drained and will remain solid. The leaf mold and peat removed should be used as topsoil

along other parts of the trail and for planting operations.

Trail Finishing

How far should one go on trail finishing? Generally, refined grading is not practical. Most trails will probably receive a relatively small amount of maintenance. The best answer to this question is that trail finishing should be carried to the point where erosion will be discouraged and natural plant growth will be encouraged. Such finishing can be justified from the practical standpoint. All trails will require occasional maintenance to keep them in good condition, and finishing them to hold upkeep to a minimum is one of the guiding factors in good trail construction. When banks are not properly sloped, walls not well built, and drainage not properly provided, constant maintenance will be necessary and the cost of upkeep will increase.

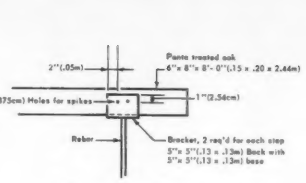
This article is based on an article by Guy E. Arthur, US Department of the Interior, which appeared in the Park Practice Program, Oct., 1975. It appeared previously in PARKS in 1976.

Steep Grade Trail Steps

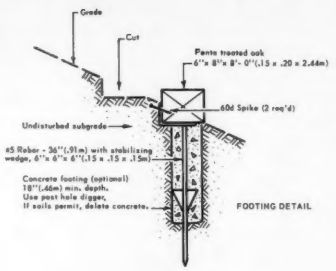
If you're tired of the common "straight up the hill" trail steps, here's a flexible system, submitted by Dennis P. Fehler, landscape architect at Mark Twain National Forest in Missouri, USA. Using difficult topography to an advantage, Fehler's system follows the natural contour of the land and is constructed in a way that minimizes site disturbance. With this system, a designer can predict accurately the visual effect desired for a particular site and can prepare a technical drawing that can be understood easily.

To show graphically the necessary curve for the steps, a "lime line" is drawn on the ground. Spacing of the 6′ x 8′ (15 x 20 cm) railroad tie steps varies according to the slope. To lessen site disturbance, brackets are used for step footings. Here they are welded to a 36′ (90 cm) piece of #5 rebar with stabilizing wedge. Other anchoring methods may be substituted depending upon local soil, topography, and codes.

Vegetation can be planted to soften or enhance the edge of the steps, and the vegetation can be manipulated to provide a variety of spatial effects. Erosion is reduced due to the serrated edge effect. If a step is damaged it can be replaced easily. The brackets preserve the correct horizontal and vertical alignment.

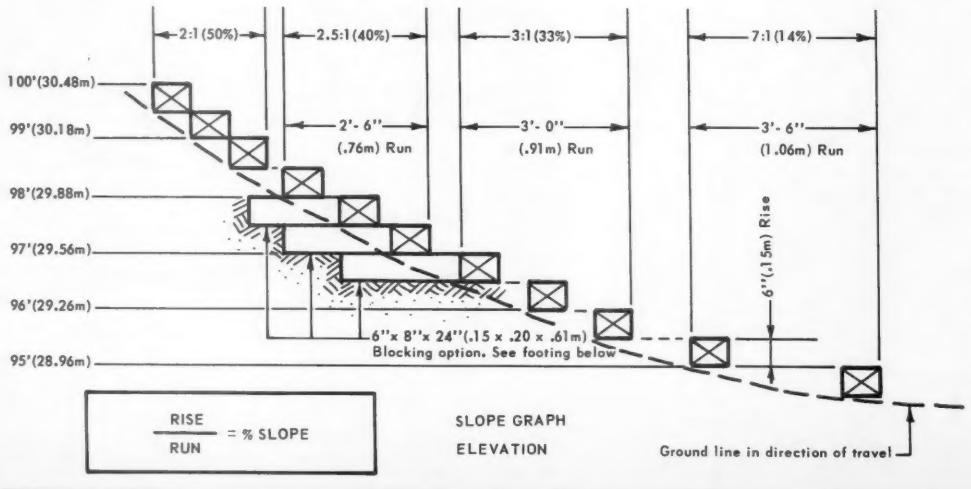


BACK VIEW OF FOOTING DETAIL


Grade
Cut
Penta treated oak
6"× 8"× 8'- 0"(.15 × .20 × 2.44m)
60d Spike (2 req'd)
Undisturbed subgrade
#5 Rebar - 36"(.91m) with stabilizing wedge, 6"× 6"× 6"(.15 × .15 × .15m)
Concrete footing (optional) 18"(.46m) min. depth. Use post hole digger, If soils permit, delete concrete.

FOOTING DETAIL

Reprinted from Design, a US National Park Service publication, Oct., 1980.



Shoreline Stabilization Through Marsh Restoration

Bonnie Lou Gay and John T. Tanacredi

(Gateway National Recreation Area is located just outside New York City, USA. It straddles the New York-New Jersey state line.)

The most encompassing problem facing Gateway National Recreation Area in the forseeable future is the impact of coastal erosion on natural, geomorphological and cultural resources. With a projected 18 million visitors per year, of which a majority come to use bathing beach areas, erosion is a significant threat through loss or damage of shoreline, cultural resources, structures and transportation corridors. Erosion causes loss of critical habitat that has been identified in Gateway's Resource Management Plan as drastically reducing species diversity while significantly affecting those areas designated for protection within the park boundaries.

The major problem becomes how to stabilize these areas. Several miles of beach surrounding New York's Jamaica Bay are subject to sand erosion by wave action, tides and storms which keep changing the profile of these beaches, sometimes overnight.

Several engineered methods have been attempted to correct the erosion threat to recreation areas with little success. Shoreline areas as they stand represent the passage of long periods of time coupled with the dynamics of shoreline geomorphological process such as wind driven waves and currents of significant force.

These factors have considerably altered the contour of the shorelines associated with Gateway NRA. In most cases, U. S. National Park Service policy has been to allow "nature to take its course." Yet in cases where the NPS has inherited a history of "engineered solutions" to the coastal erosion problem, this approach (allowing nature to take its course) may be totally incompatible with existing and projected visitor use patterns. Existing engineering techniques to control erosion involve the building of structures such as seawalls, bulkheads and revetment. These have critical limitations such as their high cost for labor and materials. New techniques involving physical intervention between sea and shore need to be explored.

Researchers are experimenting with ways of working "with nature" to protect the natural setting of shoreline areas. One such method, which has received considerable attention, is vegetative propagation of marshgrass; *Spartina alterniflora*. The principle is simple. Once a marsh is established, the marshgrass root system will collect and consolidate sand particles and thus provide a natural barrier or buffer zone to the destructive forces of waves. Along with providing a natural breakwater, marshgrass filters out some water pollutants and provides habitat for developing estuarine/marine species.

The Plumb Beach Experiment

The Plumb Beach area, once an island, has undergone dramatic configuration change. The once low-lying hassocks of marsh gave way to a major city highway—the Belt Parkway. Landfill and construction smothered the productive shellfish beds lining the periphery of Jamaica Bay. The east end of Plumb Beach (Figure 1) still harbors an extensive marsh/lagoon system. The west end is the site of critical erosion. Much of the shoreline area, public access roads and beaches were lost in a violent storm in October, 1980.

Damage at Plumb Beach resulting from a severe storm in 1980.

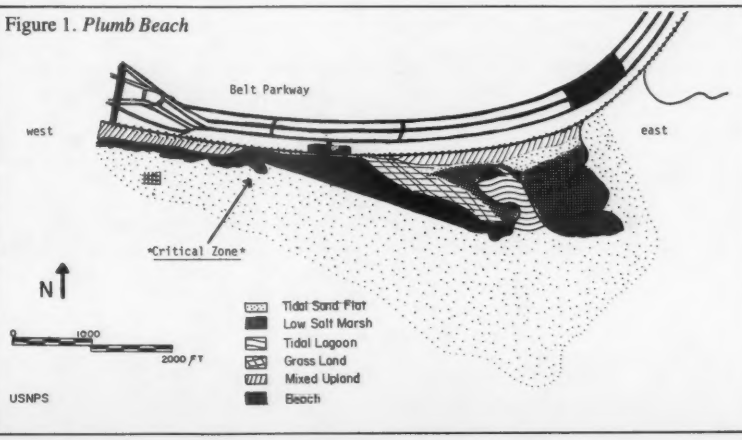
Prior to the 1980 storm, erosion prevention measures included 1) placing sandbags along the shoreline, and 2) placing timber pilings parallel to the shoreline. Neither method was effective. A pilot marsh transplanting project, conducted in 1979, met with limited success due to early impacts of Hurricane David, which killed surviving culms of *Spartina alterniflora* before their first winter season.

During the 1980 winter season, careful planning was considered for shoreline stabilization through marsh restoration. Natural marsh areas existed to the extreme west of the critical zone and to the far eastern end of Plumb Beach. Even throughout storms and hurricanes these marsh areas continued to stand as buffers for the shoreline. The parallel dune system and adjacent upland areas provided still another protective zone to this ecosystem as a whole. The "critical erosion area" of Plumb Beach had lost its upland-dune buffer zone and now had only a major highway system, within 50 feet of the high water mark. The only area left between water and highway was the tidal flat itself.

Since Plumb Beach lies within the limits of Jamaica Bay and for the most part experiences relatively shallow water waves, the dynamics and forces of its littoral environment were ideal for a marsh restoration program. Plumb Beach lies close to both lower New York Bay and the Atlantic Ocean (buffered by the Breezy Point peninsula). This is an important factor when one considers relative water patterns during extreme weather conditions. Other factors contributing to the erosion of Plumb Beach include (1) the presence of a dredged navigational channel (used to gain entry to Sheepshead Bay), and (2) the presence of a rip-rap wall that may have played a role in depleting the sediment supply to the Plumb Beach shoreline.

During low tide, current ripple marks are evident throughout the tidal flats, and as in most

Figure 1. *Plumb Beach*



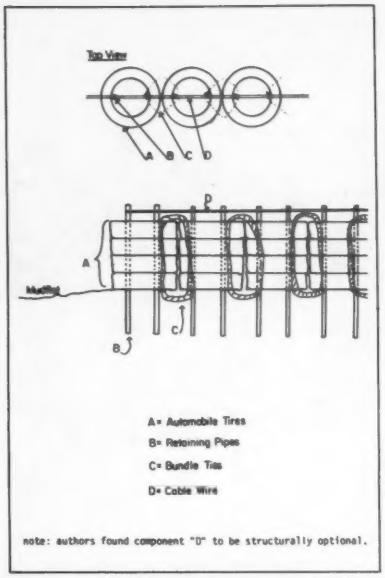


Figure 2. *Tire Mattress Construction Guide*

Detail of the floating tire mattress at Plumb Beach, showing how the tires are anchored to the bottom and to each other.

eroding areas an angled wave approach to the shoreline exists. Still, there was marsh development to the east and west of this critical zone. The question was how to get marsh culms to exist long enough to comprise a viable system in Plumb Beach critical zone . . . how could the park successfully slow down wave action to establish a marsh with relatively little cost and alteration to the natural environment?

At about this time the Coastal Engineering Research Center of the U.S. Army Corps of Engineers received congressional funds for the development of low cost erosion control structures. One such project was the "FTB," or Floating Tire Breakwater. Its function is to decrease the amplitude of incoming waves to a particular shoreline. Researchers tested wave energy reduction with FTBs in harbor areas and found them successful.

One variation of the FTB is the "tire mattress." Its major function is to absorb and reflect energy from incoming waves. Unlike the FTB the tire mattress rests on something, in this case, on the tidal flats. Correctly positioned on the tidal flats, a tire mattress could serve to reduce wave energy within a marshgrass planting site.

Phase I: Tire Mattress Construction

With approvals from the Army Corps of Engineers and the New York State Department of Environmental Conservation, construction of a tire mattress by Gateway NRA at Plumb Beach began in the spring of 1981 and ended in May of that year. The project took longer than expected, as we did not estimate alternating work weeks due to tide conditions. The tire mattress at Plumb Beach is 440 feet (134 m) long and lies parallel to the shoreline, about 260 (80 m) feet into the inter-tidal zone on a gently sloping mudflat. The bundles are held in position by pipes and are attached to one another by plastic encased steel cable (see Figure 2).

Perpendicular to the shoreline lie six shorter segments of tire bundles called "finger projections." Their function is to trap moving sand. Used together, the tire mattress and finger projections slow down wave action and build up sand.

Phase II: Marsh Development

The primary goal of this project is to establish a marsh system. With the completion of the tire mattress and finger projections the site was ready for grass. Because of the advanced stage of the growing season (mid-August), a pilot planting was substituted for full scale planting. Transplants of marshgrass within the project site tested a range of parameters: commercial stock vs. natural culms, different locations within the critical zone, different sediment types (i.e., presence of clay or peat deposits), and first year vs. second year growth. The comparisons proved informative and the preliminary results set the standards for later marsh restoration work at Plumb Beach.

Researchers continue to document information on marsh development and restoration as an aid to those who wish to propagate this valuable species of grass. Commercial stock has proven to be less labor intensive to transplant and has a higher survival rate than transplanted "natural" (existing) culms.

Spartina alterniflora plays a significant role in the estuarine environment. It provides an intricate, multifold link to the marine ecosystem. *Spartina alterniflora,* a dominant inter-tidal species, is found growing along coastal fringes of the eastern United States. Patches of marshgrass known as "stands" supply our coastal waters with a nutrient source that surpasses in primary productivity any other agricultural system.

To marine and estuarine species *Spartina alterniflora* is most valuable in its decomposed form. Marshgrass dies back after a spring-summer growing season and takes another form known as "detritus." This microscopic plant material is carted out by the tide to the surrounding bay waters and is utilized by developing estuarine organisms. It is a key component of this marine food chain. Without the continuous contribution of this nutrient material to our coastal waters, there would be a marked decrease in abundance of marine life and, in turn, reduced productivity.

Marshlands, often referred to as wetlands, are universally know as the "ocean nursery." It has been estimated that 70 percent of all marine life depends on marshes during some point of its existence, whether for food or as a site for breeding. Birds and small mammals also make use of wetlands. Other beneficial conditions that may result from this marsh development/erosion protection project include creation of a natural breakwater to mitigate the forces of storm conditions and waves, and an increased production in natural peat soils (which will absorb run-off water during rain and storm).

The existence of marsh should increase the ability of the area to absorb sewage effluent, which, with the addition of suitable grasses to "take it up," becomes a nutrient instead of a pollutant. In the marsh, excess nutrients would produce increased growth for marshgrass, providing an increased supply of food energy to the food chain. Disposal of wastes high in nutrients (such as sewage effluent) would be less disruptive to the Jamaica Bay ecosystem if absorbed by the saltmarsh rather than being emptied into open water.

Conclusion

Reduction of shore erosion presents many problems, most of them relating to the high cost of design and construction of protection structures. This calls for careful correlation of protective measures with a specific site's physical conditions and coastal geomorphological processes. Areas such as Plumb Beach contain within themselves the potential solution to their erosion problems through marsh development. With the temporary addition of wave damping devices such as the tire mattress, project cost factors are considerably reduced.

The feasibility of working with tires is important both economically and practically. Tires used in such stabilization structures are capable of deforming up to 30 percent without permanent change in shape. Because of their relative inertness, tires experience a slow breakdown of structure, maintaining strength and flexibility for long periods of time. Best of all, tires are inexpensive and plentiful. In addition, their use in bank stabilization helps solve a waste tire problem.

The benefits of a marsh system to the environment and the surrounding waters of Jamaica Bay include provision of habitat for many species, a buffer zone for wave action and flood plain areas, and a natural sink for a variety of pollutants. Marsh creation will increase biomass and productivity to the bay and surrounding waterways.

This first of what is planned to be several marsh restoration shoreline stabilization projects of Gateway NRA proposes to reestablish a valuable yet dwindling urban natural resource: namely our coastal wetland environments.

Bonnie Lou Gay is the Resources Management Technician for the Jamaica Bay District and John T. Tanacredi is a Natural Resources Management Specialist with Gateway National Recreation Areas (NY-NJ).

Reprinted from Trends, *1982, U.S. National Park Service. Photos: John Tanacredi*

Continuous Line-Intercept System for Measuring Groundcover Changes

R. E. Leonard and J. C. McBride

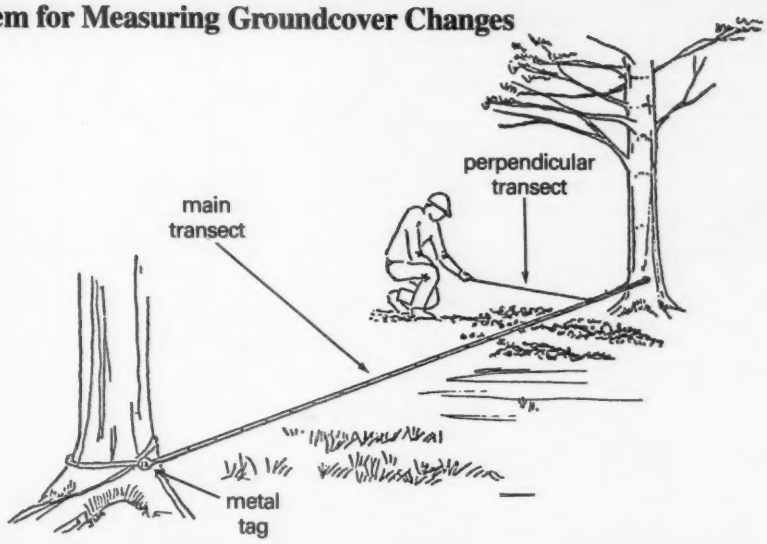
A modified point-intercept transect system has been used on backcountry campsites and trails to measure baseline conditions and low-use impacts on groundcover. Based on a continuous sample intercept rather than discrete points, this method provides more information (in addition to reducing field time) than the conventional sample point system.

One main transect forms the basis for this continuous line-intercept system. It is permanently located by numbered metal tags nailed to the base of trees at each end. It can be relocated exactly and measurements can be duplicated. The measurement system includes three functions: (a) continuous sampling along the main transect; (b) continuous sampling along perpendicular transects; (c) recording of individual plants.

Vegetation is recorded along the transect according to broad categories of groundcover such as moss mat, duff layer, and exposed organic soil; specific herbs that make up part of the groundcover also are labeled.

Sampling on the main transect is accomplished by recording the distance along the transect to the nearest .05 meter that each species or cover touches or intercepts the line. Each cover type is listed in order of dominance or greatest percent coverage. Thus, if field notes list moss, duff, and blueberry mat in that order, moss would be the dominant cover and blueberry the least important. However, all three are somewhat intermixed.

Transects that are perpendicular to the main transect are laid out at ½-meter intervals. The length of these perpendicular lines depends on the area that needs to be measured. If the camping area is larger than 4 meters to either side of the main transect, another permanent transect can be set up with additional perpendicular lines coming from it. In contrast to the permanent nature of the main transects, these perpendicular transects are simply lines held at right angles to the main transect. Continuous sampling is taken of the broad types of cover intercepting these lines.



Counting individual plants such as woody seedlings or single occurrences of forb species that are present within 4 meters to either side of the line helps monitor trampling impact. Each plant position is recorded with a tape perpendicular to the corresponding point on the transect so that distance can be recorded. Each plant can be checked at consecutive measurement dates for its presence or absence and for any increase in height or dieback.

By listing the total interception in meters along each transect of each plant species and cover and then relating each coverage to the total length of the line, a relative percent cover and a relative change in cover can be determined and plotted. Individual plants can be plotted according to the number of additions or losses of each species as trampling occurs.

Several types of bar graph can be drawn to compare these data from different perspectives. All of the cover types can be included on one graph with each order of dominance on separate graphs. By this method, the shift in dominance of one cover type can be compared and perhaps correlated with that of another. Another method is to plot each cover type separately but include all orders of dominance so that shifts of one cover type from 3° to 1° dominance or vice versa are visible.

The continuous line-intercept system is easy to implement at a campsite or trail since only one permanent transect needs to be laid out (unless area is large enough to accommodate more). Taking continuous measurements is quicker than taking samples at even intervals because if one cover type intercepts the line for 10 meters, only 1 field note is needed as opposed to 20 notes at ½-meter intervals. This system is easily relocated and duplicated during the season and in subsequent years. It can be applied to any dispersed recreation area.

Dr. R. E. Leonard is Project Leader of the Dispersed Recreation Project at the U. S. Forest Service's Northeastern Forest Experiment Station in Durham, New Hampshire, USA; J. C. McBride was a Biological Aide in the same project when this paper was prepared.

Offset Footbridge

Here is an idea for a small footbridge that is laid out to discourage two of the most unwelcome users of foot trails: horseback riders and cyclists. Additionally, the bridge invites walkers to pause in transit, and this contributes to its charm.

The structure need not be complicated but it is more than a couple of tree trunks thrown across a stream. The center offset rests on a joist, and this timber must be suitably supported. In this example the joist rests on posts set on stringers which cross the creek well above the usual water level. The stringer can rest on piles or on sills of timber, rock or concrete.

This bridge was developed by the U. S. National Park Service.

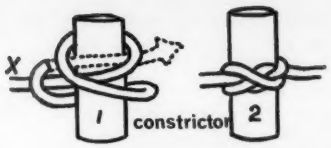
Knots You Should Know: the Constrictor

There are perhaps a dozen knots, bends, and hitches anyone in active field work ought to be able to use without having to think about how they are made.

In addition, there are a dozen or so special knots of the hundreds that have been developed over the centuries that ought to be noted and provisions made for future reference. One of these is the constrictor, a variation on the old and widely used clove hitch. Once in place and drawn tight, the constrictor is extremely difficult to untie or loosen.

This quality, of course, suggests its use. For permanently fastening such things as rungs in a rope ladder, securing guys, etc., it is exactly right. I use it on a sailboat to permanently fasten tiers on the ends of a couple of special purpose poles. A longish line, say 6 feet, fastened with the constrictor at the end of a pole, becomes two permanent tiers.

As a first step to tie the constrictor let us look at the old familiar clove hitch, above. This hitch has many temporary uses but it will slacken and fall unless it is under a load — preferably a steady load on each side.



The constrictor does not require a load to keep it tight. To tie it, follow the diagram above, starting at X. It is quite easy, as you will discover after a few tries. Note how tight it sets and how firmly the ends of the rope on each side of the hitch are held in place. This is its special virtue, of course.

We are indebted to *Yachting Monthly*, London, for permission to use these drawings from their October, 1973, issue.

—R. I. Standish

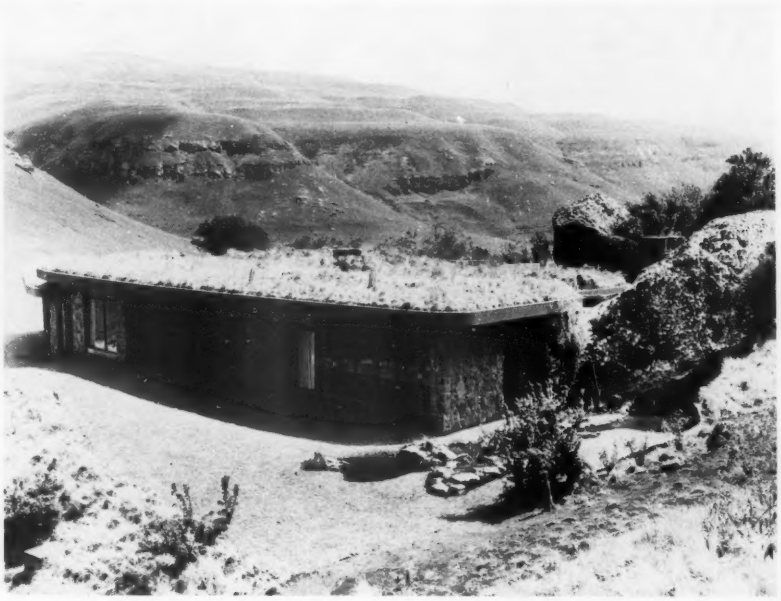
Unique Park Accommodation

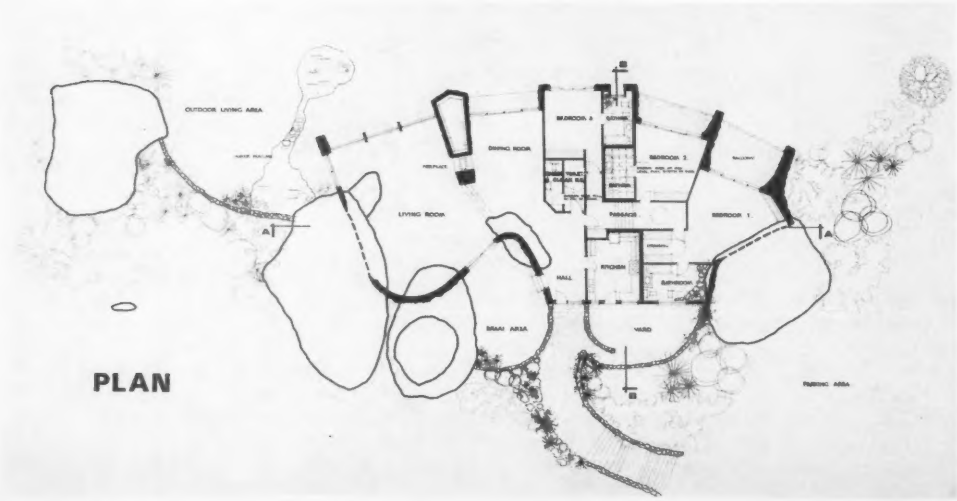
A wide range of accommodation for overnight visitors is made available in the larger parks and reserves of Natal, South Africa. Facilities range from sample camping sites to fully-furnished cottages. Most are fairly straightforward in design and construction but one recently-completed facility is unique. This is a luxury cottage, the Giant's Lodge, in Giant's Castle Game Reserve, one of Natal's largest and oldest parks.

Designed by Gordon Cunningham, Giant's Lodge is built into the terrain, which is spectacular. Exposed walls are stone, and with its wide overhanging eaves and flat roof covered with native sod, the structure blends unobtrusively into the landscape and takes full advantage of weather and location factors. The Lodge will handle a maximum of 7 visitors.

Giant's Lodge is the most luxurious accommodation offered by the Natal Parks, Game and Fish Preservation Board in any of the 50 sites under its management.

—R. I. Standish





BOOKS AND NOTICES

Conserving the Natural Heritage of Latin America and the Carribbean: the Planning and Management of Protected Areas in the Neotropical Realm. International Union for Conservation of Nature and Natural Resources, Avenue du Mont Blanc, CH-1196 Gland, Switzerland. 1981. 329 p. Price: US$15.00.

These are the proceedings of the eighteenth working session of IUCN's Commission on National Parks and Protected Areas, held in Lima, Peru, during June 1981, with field sessions in Lachay, Paracas, and Pampa Galeras National Reserves. The four major objectives addressed by the 53 participants and 30 observers were:

- To present some new concepts of importance to managing protected areas;
- To compile information on the protected area of the neotropical realm;
- To discuss ways of developing the capacity to manage protected areas;
- To promote international support for protected area management.

Unesco's efforts on behalf of protected areas are discussed in relation to the Man and the Biosphere Programme and the World Heritage Convention.

National Parks in Crisis. 1982. Edited by Eugenia H. Connally. National Parks and Conservation Assn., 1701-18th St., NW, Washington, DC 20009/USA. 220 pages. US$14.00 plus $1.50 postage and handling.

Concerned about the future of the US national parks, the National Parks and Conservation Association hosted a conference of citizen experts to "provide a framework for the development of a comprehensive National Park System plan; and . . . provide a basis for alerting the public about the current problems . . ." This book is a collection of conference papers presented by leading park authorities from every walk of life.

In reading the various papers, one gets a distinct feeling that two of the primary concepts in the national park program are in direct conflict. National parks are for public use — for enjoyment, relaxation, recreation, and education. They are also for protection and preservation of nature's grandeur relatively untouched by man. As use increases, preservation suffers. It is the imposing task of easing this confrontation that the conference addressed.

The list of participants and contributors is impressive. Robert Cahn, former member of the President's Council on Environmental Quality, reports on his studies of public reaction to various parks programs. He declares that "National parks are . . . valued as samples of the nation's ecological variety and habitat for endangered or threatened species . . . They constitute a harbinger for the future and an early warning system for what we are doing for our entire habitat."

In another paragraph Cahn discusses "the people problem," noting that as early as 1865 Frederick Law Olmsted, Yosemite Park protection advocate, warned that "as an injury to the scenery so slight it may be unheeded by any visitor now, will be one of deplorable magnitude when its effect . . . is multiplied" by the millions he predicted would use the park in years ahead. Only a few thousand visited Yosemite then; by 1954 they had increased to a million annually, and currently the park receives well over 2 ½ million.

Michael Frome, widely-known environmental critic, wrote an award-winning series, "The Un-greening of our National Parks." His thought-provoking comments were adapted for the NPCA Magazine and appear in this book. Among many other things, Frome tells of South Africa's controlled access to the great Kruger National Park, brought on, in large part, by an ever-increasing public use. Kruger, he states, has seven entrance stations; requires reservations "for huts, bungalows and campgrounds," and even for day-use. Visitor quotas are assigned; after they are filled, the gates are closed. Such limitations, he insists, would not restrict the tourist potential of a system, "but rather points to the value of establishing new national parks."

Cecil D. Andrus, former Secretary of the US Department of the Interior, writes in his treatise on the value of wilderness, "A national park is a portrait of sanity in an often insane world, and a portrait of peace in a troubled world." F. Ross Holland tells of the unique experiment the National Park service is carrying out in Lowell, Massachusetts, where virtually the entire city is parkland and its former industrial glory, now long passed, is the subject of historical preservation. Joseph L. Sax, professor of public land law at the University of Michigan, sees need for compromise of original ideals with current demands if the park system is to continue to function effectively.

Contributors to this volume and participants at the 1981 conference express cautious optimism. They see the dangers and they are concentrating their talents toward solutions.

National Parks in Crisis is divided into three sections: problems in the national park system, planning for the future, and recommendations. It is a highly readable collection of authentic data and serious opinion. The last section, "Politics and the Parks," contains hints and suggestions that are applicable to park systems throughout the world. —*Dave Roberts*

What's Wildlife Worth, 1982 and **Genes from the Wild,** 1983. Robert and Christine Prescott-Allen. Earthscan (IIED), 10 Percy Street, London W1P ODR, England. 92 and 101 pp, respectively. Paperback. £3.00 or US$7.00 each.

In the 1960s and the early '70s one often heard questions raised about the importance of saving wildlife, especially endangered species. Quite a few people, including folks who otherwise seemed to be intelligent, seriously questioned the value of any single species — presumably excluding *Homo sapiens.* During the last two decades questions of this sort ought firmly to have been laid to rest. But obviously the basic reasons have failed to register with a great many people, and have not even been exposed to vast numbers of others in the flowing river of humanity.

What's Wildlife Worth? is an easy way into this complex subject. It is short and succinct and adequately scientific without footnoting every detail. An attentive reader of reasonable mind will gain an excellent general idea of the economic contribution of wild plants and animals, especially to developing countries.

Societies around the world have not questioned the value of wild genetic material in quite the same way the values of wild animal species often have been pooh-poohed. They have, rather, generally swept over the topic in the heedless rush for hamburger and plywood (that may be putting it a bit strong, but the facts are close). Unfortunately, this is a matter that cannot long be ignored . . . except at our own peril. Once a species is dead it's dead, and all of our vaunted scientists together couldn't resurrect it. *Genes from the Wild* adequately though briefly discusses the whole topic of wild genetic resources, and what mankind stands to lose if we fail to protect these incalculably valuable raw materials.

This pair of paperbacks ought to be required reading for everyone having or considering a career in government, "big" business, international assistance and the like. Small and modest as they are, these two books distill the basic essence of what we mean by conservation. More importantly, they relate it to availability of the basic requirements of living, which is what enlightened conservationists mean by the term "development."

The authors, Robert and Christine Prescott-Allen, a pair of impecably qualified conservation practitioners, operate PA DATA, a research group working on the sustainable use of plants and animals. They are based in Victoria, British Columbia, Canada. These two books benefited from an Earthscan program on wild genetic resources funded by the Swedish Inter-

national Development Authority. Incidentally, Earthscan's paperbacks now constitute quite an impressive list. —*Robert I. Standish*

Environmentally Sound Small Scale Forestry Projects, 1983. Robert F. Ffolliott and John H. Thames. CODEL-VITA. Paperback, 109 pages. US$5.95. Order from VITA, 1815 N. Lynn Street, Arlington, VA 22209, USA.

This is the third volume of the "Guidelines for Planning" series being produced by the joint efforts of CODEL Inc. (Cooperation for Development) and VITA (Volunteers in Technology), both groups based in the US. The first book, *Environmentally Sound Small Scale Agricultural Projects,* appeared in 1979 and is now available in French and Spanish as well as English. The second booklet, *Environmentally Sound Small Scale Water Projects,* was published in 1981 (See PARKS, Vol. 7, No. 1). Additional volumes on energy and on livestock raising are in preparation.

As with the earlier books, this one is intended for use by small groups of people: several farm families, a cooperative, a village or two, perhaps a tribe. It is designed to promote small-scale projects that are technically planned and environmentally sound, and to serve as a tool to transfer the necessary technical expertise to carry out such projects on a sustainable basis.

Authors Ffolliott and Thames, both professors in the School of Renewable Natural Resources at the University of Arizona, USA, lay out their excellent guidelines in 12 chapters, illustrated with simple drawings and charts, all in easy to understand language. The work is sound and the coverage quite adequate for the intended use. An excellent bibliography and ecological guidelines for community development projects follow the text. —*R. I. Standish*

Liberia Establishes First National Park

In recognition of the valuable natural resources that have been exploited, in many cases to the point of extinction, CIC Samuel Kanyon Doe, Chairman of the People's Redemption Council and Head of State of the Republic of Liberia, signed on 19 May 1983 a decree declaring the Sapo National Forest as the first national park of Liberia.

Sapo National Park consists of 323,075 acres of primary forest land; it is situated in Sinoe County, between the eastern bank of the Sinoe River and Wanna Creek, and is fully controlled by the Forestry Development Authority. All encroachment on the park by farmers, hunters, and other developers is strictly forbidden.

Signup for 1984 Parks Seminar Ends March 30

The 18th International Seminar on National Parks and Equivalent Reserves, cosponsored by the U. S. National Park Service, The University of Michigan, and Parks Canada will be held Aug. 7-Sept. 7, 1984. The itinerary will include visits to parks and other protected areas in southwestern Canada and the western United States, including Hawaii. The purpose of the Seminar is to examine policies, administration, planning and other aspects of management of national parks and equivalent reserves. The primary emphasis will focus on natural areas with secondary emphasis on cultural resources. The Seminar is offered in the **English** language only. The registration and tuition fees, materials, meals and lodging, and Seminar travel will cost approximately US$3,000. Additional personal expenses as well as travel to and from the Seminar are not included in this figure.

Enrollment in the Seminar must be limited to 36 participants. Only those applications received by March 30, 1984 will be considered by the selection committee. All inquiries and applications should be directed by airmail or telegraph to:

Tom D. Thomas, Director
International Seminar on National
Parks and Equivalent Reserves
School of Natural Resources
The University of Michigan
Ann Arbor, Michigan 48109, USA
Telephone: (313) 763-4029

Information For Contributors

PARKS magazine is distributed throughout the world on a controlled basis. It is edited primarily as a technical and management journal for national park personnel, and deals with natural, historical and cultural matters involved in national parks and other protected areas. All aspects of planning, management, use, and operation of these areas are subjects considered for publication.

Authors are usually professional people engaged in park management, or in the many disciplines associated with parks and protected areas. Normally authors will be invited to write on subjects selected by the editors, but those who have ideas based on their own experience who would like to submit articles up to about 2000 words for consideration are requested to write to the Editor before preparing manuscripts.

Unsolicited original manuscripts are also welcomed for consideration by the editors. Such material will not normally be returned to its sender unless this is specifically requested.

Manuscripts should be submitted in English.

Suitability for publication is determined by many factors. These include factual and technical content, timeliness, and potential value to our international audience.

Authors will be advised as promptly as possible if their contributions are accepted for publication. In most cases, several exchanges of correspondence should be expected since all manuscripts must be edited. This may involve text cuts or additions, and changes required for understanding by an international audience.

It must be understood that publication cannot be guaranteed. There may even be instances, where manuscripts that have been accepted and edited are withdrawn from the publication schedule.

PARKS magazine is not copyrighted. material protected by copyrights held by authors will be considered for publication, however, provided suitable assignment of the right to publish is made to us.

Manuscript preparation specifications will be sent on request.

1984 International Workshop on Environmental Education/Interpretation

The Fourth International Workshop on Environmental Education/Interpretation, sponsored by the Center for Tropical Agricultural Research and Training (CATIE) and the Costa Rican National Park Service, will be held at Costa Rica's Manuel Antonio National Park June 4-29, 1984. Field visits will be made to nearby areas administered by the Costa Rica National Park Service.

The purpose of the Workshop is to provide wildland managers with an introduction to environmental education/interpretation consisting of both concepts and practical information which can be adapted for use in the parks and protected areas of their respective countries. This year's emphasis will be on programs with communities surrounding the parks and reserves, directly involving such communities in the entire process of educational design and execution.

The Workshop is offered in the **Spanish** language only. Fees, materials, meals and lodging, and Workshop travel will cost approximately US$800. Additional personal expenses as well as travel to and from the Workshop are not included in this figure.

Enrollment in the Workshop must be limited to 20 participants, with preference given to those from Latin America and the Caribbean. Only those applications received by April 30, 1984, will be considered by the selection committee. All inquiries and applications should be directed by airmail or telegraph to:

Dr. Craig MacFarland, Coordinator
International Workshop on
Environmental
Education/Interpretation
Wildlands and Watershed Program
CATIE
Turrialba, Costa Rica
Telephone: (506) 56 64 31
Telex: 8005 CATIE CR
Cable: CATIE, Turrialba, C.R.

Harper's Ferry National Historical Park, West Virginia, USA, nestles in the bend of the Potomac River where it is joined by the Shenandoah River. The National Park Service Stephen T. Mather Training Center is located within the park, site of the International Workshop on Environmental Interpretation in September, 1983. Photo Tom Gray, National Park Service.

Back cover: Shallow clear waters within protected lagoons and along the reefs fringing the islands in the Great Barrier Reef Marine Park provide some of the world's finest diving and excellent underwater research sites. ANPWS photo by Gordon Anderson

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